Aerial Movement and Deposition of Diazinon, Chlorpyrifos, and Ethyl Parathion

By

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February, 1993

ENVIRONMENTAL HAZARDS ASSESSMENT PROGRAM

STATE OF CALIFORNIA
Environmental Protection Agency
Department of Pesticide Regulation
Environmental Monitoring and Pest Management Branch
1020 N Street, Sacramento, California 95814

EH 93-04

EXECUTIVE SUMMARY
Of Report EH 93-04 Entitled
"Aerial Movement and Deposition
of Diazinon, Chlorpyrifos, and Ethyl Parathion"

Environmental Monitoring and Pest Management Branch
Department of Pesticide Regulation

PURPOSE

Previous studies have demonstrated that some organophosphorus pesticides (OPs) move from application sites to non-target crops. The purpose of this study was to determine if aerial movement and deposition of three organophosphate insecticides (chlorpyrifos, diazinon and parathion or their oxygen analogs) occur on non-target crops as a result of agricultural applications during the summer months in two agricultural regions of California.

BACKGROUND

During the winters of 1989 and 1990 the California Department of Pesticide Regulation monitored the aerial movement of three OPs used as dormant sprays in California orchards.

This monitoring demonstrated that during the winter, OPs are regionally transported and deposited on non-target vegetation during fog and dry weather as a result of drift either during or after application. The results suggested that pesticides contained in fog may have come from applications made outside a 400 meter zone as well as from closer applications. If inadvertent OP residues occur on non-target vegetation during the winter months, it is possible that OPs applied during other times of the year might also move to non-target crops. The following investigations were conducted during the 1991 summer months to confirm this possibility.

STUDY METHODS

Since Fresno and Monterey County have high summer agricultural use of the three OPs, 14 and 15 monitoring sites, respectively, were selected in these counties. Monitoring sites were located at least 0.4 km from anticipated applications of these OPs.

Potted parsley and bell pepper plants were used to capture OPs and their oxygen analogs that have aerially transported from a distance greater than 0.4 km from anticipated applications. The vegetation was sampled after two weeks and four weeks of exposure to ambient air. In addition, air samples were collected at two of the monitoring sites in each county on three different days for eight hours by drawing air through Hi-Vol glass jars. Furthermore, deposition of pesticide residues on mass

deposition sheets during the dry season was investigated to see if measurable deposition occurred over short time periods. Deposition sheets were set out at each monitoring site at the same time plants were deployed and the sheets were collected the following week.

RESULTS

Fresno County

After two weeks exposure to air, the parsley plants at one site contained a residue concentration of 41 ppb for diazinon, while three other sites contained residue concentrations of 26, 10 and 31 ppb for chlorpyrifos. After four weeks exposure to air, the parsley plants contained diazinon at two sites with concentrations of 110 and 22 ppb and chlorpyrifos at two other sites with concentrations of 12 and 24 ppb. Additionally, one site contained residue concentrations of 48 ppb for diazinon and 27 ppb for chlorpyrifos.

Diazinon, chlorpyrifos, parathion, and diazoxon (diazinon analog) were detected in ambient air samples collected with maximum concentrations of 2.9, 0.077, 0.025 and 6.2 ppt, respectively. These OPs were detected in four of the six total air samples collected at the two monitoring sites. Chlorpyrifoxon (chlorpyrifos analog) and paraoxon (parathion analog) were not detected.

Monterey County

After two weeks exposure to air, diazinon and chlorpyrifos were each detected at two sites, at a maximum concentration of 23 and 13 ppb, respectively. After four weeks exposure to air, the parsley plants contained residues of diazinon at two sites while seven sites contained residues of chlorpyrifos. Concentrations of diazinon were 60 and 99 ppb and chlorpyrifos residues ranged from 11 to 100 ppb. One site had residues of both diazinon and chlorpyrifos. However, this site did not meet the original site selection criteria because an application of chlorpyrifos was made within the 0.4-km radius during the exposure period.

The three OPs were detected in all six air samples while the oxygen analogs were detected in three samples. Maximum air concentrations were 0.032, 1.8, 0.051, 0.085, 1.0 and 0.054 ppt for diazinon, chlorpyrifos, parathion, diazoxon, chlorpyrifoxon, and paraoxon, respectively.

There were no detectable residues of OPs or oxygen analogs on bell pepper, or oxygen analogs on parsley in both counties. No OP residues or their oxygen analogs were detected on any of the 29 mass deposition sheets after one week of exposure to ambient air.

CONCLUSIONS

The presence of all three OPs and oxygen analogs in ambient air samples and residues of diazinon and chlorpyrifos on parsley demonstrated that regional aerial movement and deposition of organophosphorous pesticides occurred in Fresno and Monterey Counties, California during the summer months. The Medical Toxicology Branch of the California Department of Pesticide Regulation determined that the concentrations found do not constitute a human health concern. These results suggest that economic loss could occur if inadvertent pesticide residues are regionally transported from an agricultural application site onto crops which do not have established tolerances for the pesticide. The diazinon residues found are well below the tolerance level of 750 ppb on parsley. However, there are not tolerances established for chlorpyrifos and parathion on parsley. Typical established tolerances on other crops range from 50 ppb to 15,000 ppb for chlorpyrifos and 1000 ppb to 5000 ppb for parathion.

In addition, bell pepper plants and mass deposition sheets appear to be inefficient surfaces to capture residues of these OPs and their oxygen analogs under the conditions of the study. This finding indicates that not all crops would be susceptible to inadvertent residues as a result of regional transport.

Factors that influence regional aerial movement to non-target vegetation include the proximity of the application to the monitoring site and regional wind patterns.

Future research concerning off-site movement might include examining factors which can be controlled such as 1) applying different pesticide formulations and measuring subsequent off-site movement; 2) using different application methods under varying meteorological conditions and documenting the mass of pesticide moving off-site; and 3) using tracer analysis to facilitate the determination of the pesticide source and distance of pesticide movement.

John Sanders
Branch Chief

March 1994

AERIAL MOVEMENT AND DEPOSITION OF DIAZINON, CHLORPYRIFOS, AND ETHYL PARATHION

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FEBRUARY, 1993

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ENVIRONMENTAL HAZARDS ASSESSMENT PROGRAM

ABSTRACT

Aerial movement and deposition of three organophosphorus pesticides (OPs) was monitored in August 1991 in Fresno and Monterey Counties, California. These counties have high summer agricultural use of the OPs: diazinon, chlorpyrifos, and ethyl parathion (parathion). Monitoring sites were located at least 0.4 km from anticipated applications of these OPs. Parsley and bell pepper plants were used to capture gas- and/or particle-phase deposition of these OPs and their oxygen analogs at 14 and 15 monitoring sites in Fresno and Monterey Counties, respectively. In addition, air samples were collected at 2 of the monitoring sites in each county. In Fresno County, the maximum concentrations of OP found on parsley were 110 ug/kg (wet weight) for diazinon and 27 ug/kg for chlorpyrifos. Only chlorpyrifos was detected on bell peppers at one site, at a concentration of 22 ug/kg. In Monterey County, the maximum concentrations of OPs found on parsley were 99 ug/kg for diazinon and 100 ug/kg for chlorpyrifos. Parathion was not detected on vegetation in either county. In Fresno County, maximum air concentrations were 35.7, 1.1, and 0.3 ng/m3 for diazinon, chlorpyrifos, and parathion, respectively. In Monterey County, maximum air concentrations were 0.4, 26.3, and 0.6 ng/m3 for diazinon, chlorpyrifos, and parathion, respectively. Results indicate that parsley plants are more efficient at trapping air-borne residues of pesticides than bell pepper plants. In terms of sensitivity, air sampling appears to be the most effective technique to confirm the presence of these pesticides in air. Results indicate that regional transport (distance f0.4 km) and deposition of these OPs occur in these two agricultural regions of California.

Turner et al. (1989) also documented the regional transport of four OPs during the winter season. Residues of diazinon, chlorpyrifos, parathion, and methidathion were found on dill plant and mass deposition sheets which were placed at various sites in Stanislaus County during the month of January. Diazinon, chlorpyrifos, and parathion were determined to have traveled a distance of 0.4 km or greater from unknown application sites and deposited on both types of media, which were similar to the media collected in this study. At this writing, 1989 pesticide use information for Stanislaus County was not available for these 3 compounds. Consequently, the relationship of the residue levels detected at the monitoring sites could not be compared to the pesticide application dates, location of the pesticide applications, or the amount of material applied, for each of the 3 compounds for the month of January.

ACKNOWLEDGEMENTS

The authors would like to thank the homeowners, business owners, and state, county, and city facility managers who provided us with monitoring sites. Thanks to Fresno and Monterey County Agricultural Commissioners and their staff for providing assistance and access to current pesticide use data. We are grateful to personnel who work at the Environmental Hazards Assessment Program (EHAP) for transplanting and maintaining potted plants and for help in sampling. Special assistance with graphics were provided by Linda Heath-Clark and Ara Jerahian.

DISCLAIMER

The mention of commercial products, their source or use in connection with material reported herein is not to be construed as either an actual or implied endorsement of such product.

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INTRODUCTION

During the winters of 1989 and 1990, the Environmental Hazards Assessment Program (EHAP) of the Department of Pesticide Regulation (formerly part of the California Department of Food and Agriculture) conducted research on the aerial movement of three organophosphorus pesticides (OPs) used as dormant sprays in California orchards (Turner et al., 1989; Turner et al., 1991). Results of those studies indicated that OPs are regionally transported (distance > 0.4 km) and deposited on non-target vegetation during fog and dry weather as a result of drift either during or after application. Ross et al. (1990) demonstrated that a non-OP, DCPA, volatilized and redeposited on nontarget parsley 23 m from the application site. Regional transport and deposition of several pesticides has also been reported in the literature (Lewis and Lee, 1976; Bidleman, 1989; Glotfelty et al., 1990a; Zabik and Seiber, 1991). However, inadvertent residues on non-target crops were not investigated.

If inadvertent OP residues occur on non-target vegetation during the winter months, it is possible that OPs applied during other times of the year might also move to non-target crops. Dry deposition (fallout) may be a source of inadvertent pesticide residues in agricultural areas since it has been reported that OPs, in the gas phase, can be removed from the atmosphere and redeposited (Bidleman, 1988). In addition, research has shown that the concentration of pesticides in air peak when they are used locally (Glotfelty et al., 1990a). If all factors are equal, it is thought that the area of highest pesticide concentration in air will yield the greatest deposition (Hicks, 1986).

This study was conducted to determine if regional aerial movement (distance > 0.4 km) and dry deposition of diazinon, chlorpyrifos, and ethyl parathion (parathion) occur on non-target crops as a result of agricultural applications during the summer months in Fresno and Monterey Counties.

MATERIALS AND METHODS

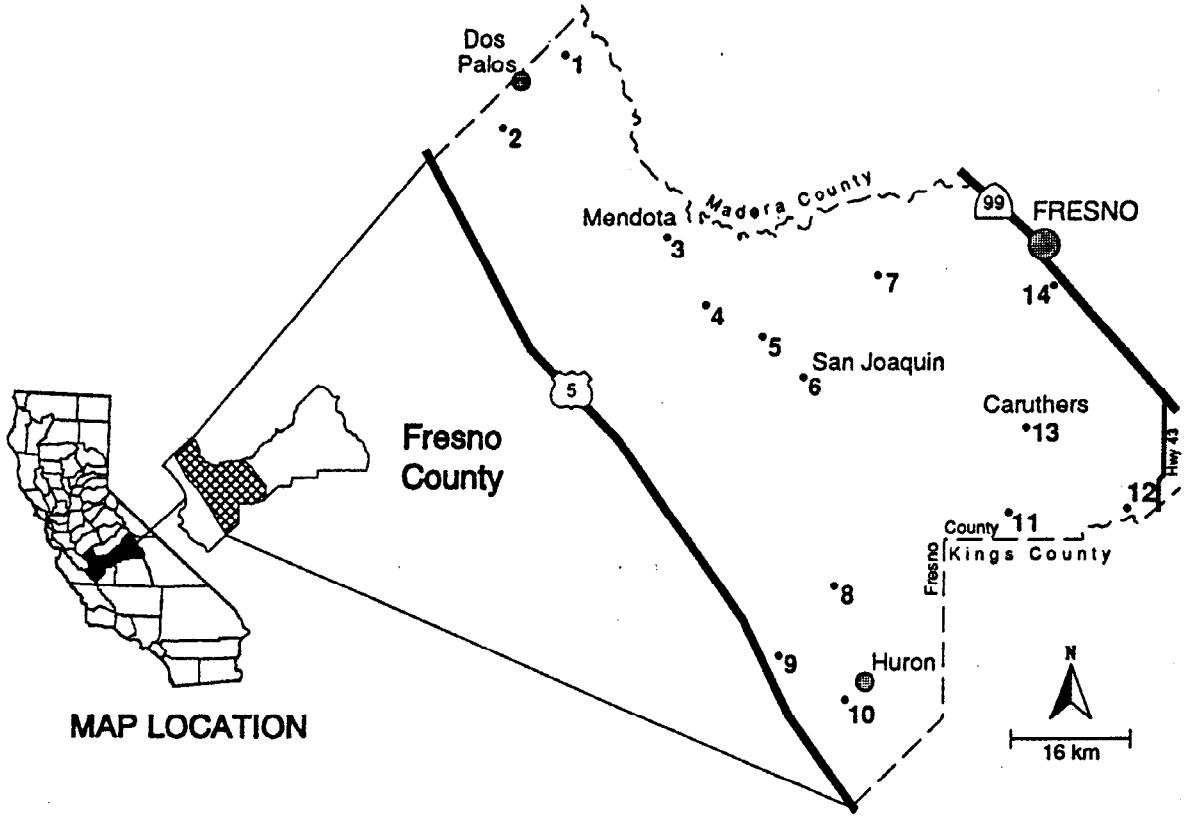
Study Area

The study areas were approximately 3,870 and 1,198 km^2 in Fresno and Monterey Counties, respectively, in California (Figure 1). These counties had high summer (June, July, and August) use of the OPs: diazinon, chlorpyrifos, and parathion (CDFA, 1988; Table 1).

Monitoring site locations were selected within the study area based on 1988 pesticide use data for summer months. This pesticide use information was the most recently available use data for determining potential sites. Pesticide use data plotted on Township, Range, and section maps were used to randomly select monitoring sites based on the following criteria: 1) sites were in or adjacent to sections of land where 1, 2, or all 3 OPs were applied; 2) no application of diazinon, chlorpyrifos, or parathion occurred within 0.4-km of the site 2 weeks prior to plant delivery; 3) these sites would not have OPs applied within 0.4-km during the 4-week study period; and 4) no tree cover or obstructions that prohibit gas or particle deposition.

Based on the above criteria, 14 monitoring sites were selected in Fresno County between Highway 99 and Interstate 5 (Figure 1). The distance be-

Figure 1. Monitoring sites for regional aerial movement of pesticides in Fresno and Monterey Counties, CA, 1991.



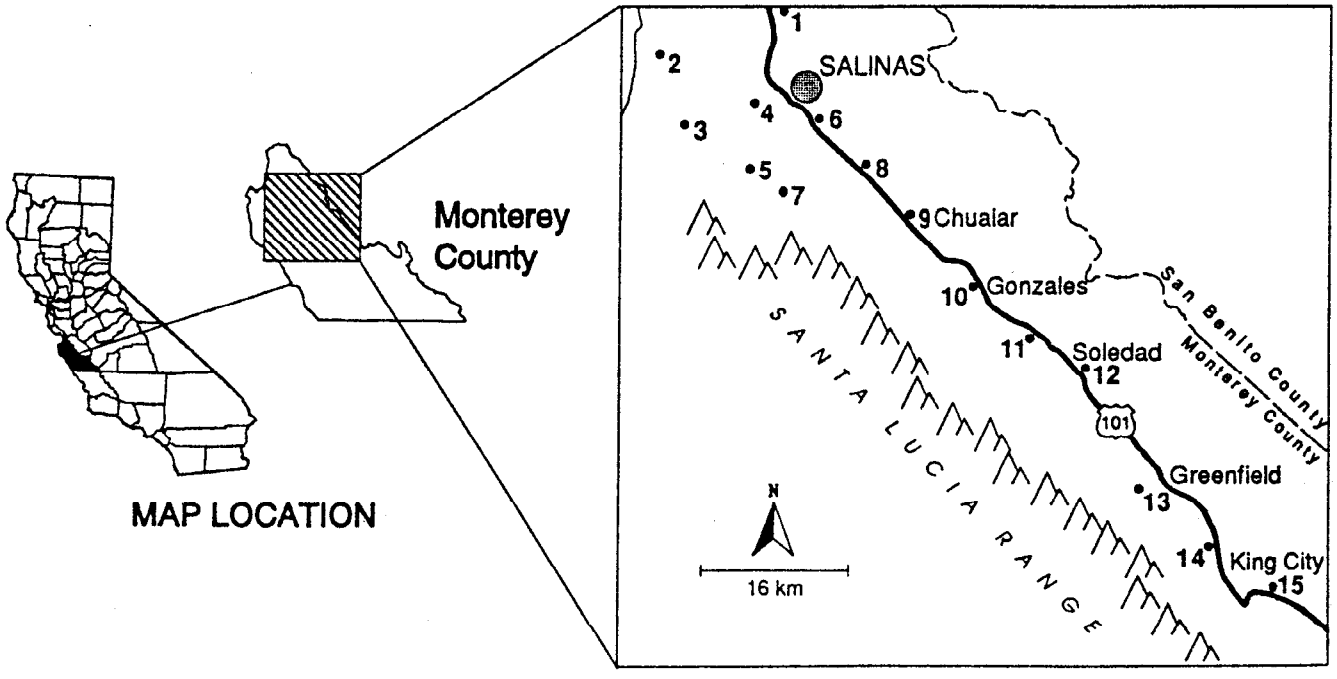


Table 1. Pesticide use for selected counties in California during June, July, and August, 1988[a].

County	Amount Applied (kg ai)		
	Diazinon	Chlorpyrifos	Parathion
Fresno	44,704	324,254	17,072
Imperial	10,298	112,461	12,482
Kern	96,115	202,972	4,507
Kings	10,793	284,429	1,547
Madera	19,833	19,270	3,883
Merced	6,527	14,663	2,581
Monterey	18,335	28,129	14,355
San Joaquin	7,399	24,248	5,486
San Luis Obispo	3,870	3,265	585
Tulare	29,244	139,064	7,223

a. California Department of Food and Agriculture, 1988. Pesticide use report.

tween sites ranged from 9.6 to 32 km. Fifteen monitoring sites were selected in Monterey County in the Salinas Valley, between Castroville and King City, with most sites located along Highway 101 (Figure 1). The distance between sites ranged from 4.8 to 14.4 km. Monitoring site locations included private residences, commercial businesses, and state, county, and city facilities.

Vegetation

Parsley and bell pepper plants were used to monitor regional transport and deposition of OPs and their oxygen analogs. The parsley plants were grown in Stanislaus County, and a cluster of plants with approximately 0.09-m^2 canopy and 15-cm tall were transplanted into 0.5-m diameter pots containing Vita-Hume® planting mix. Bell pepper plants, approximately 20-cm tall, were purchased at a nursery in Placer County. Six pepper plants were transplanted into separate 0.5-m pots. Parsley and bell pepper plants remained outdoors for 4 weeks prior to relocation to the 29 monitoring sites. Background OP levels were determined before the plants were translocated to the monitoring sites by taking composite vegetation samples from randomly selected pots of parsley and bell pepper plants, respectively.

In each county, one pot of parsley and one pot of peppers were deployed to each monitoring site within a 2-day period. Plants for Fresno County were distributed on July 29 and 30, 1991, and plants for Monterey County were deployed on July 31 and August 1, 1991. The plants were watered weekly without wetting the foliage.

After 2 weeks of exposure to ambient air, 50-g parsley samples were collected at 7 randomly chosen sites in each county and analyzed for the OPs and their oxygen analogs. After approximately 4 weeks, the remainder of the parsley and bell pepper plants were harvested. Plants in Fresno County were last sampled on August 26, 1991, while plants in Monterey County were last sampled on August 27 and 28, 1991. Plant materials collected at each site were placed into separate 1-L Mason jars and capped with lids lined with aluminum foil. Samples were placed on wet ice and stored 2 days at approximately 4°C until analysis.

Air Samples

Two of the monitoring sites in each county were also randomly selected for ambient air sampling. Each air sample was collected with a high volume (Hi-Vol) air sampler (General Metal Works®) calibrated to a flow rate of 1 m^3/min. Air samples were collected for 8 hours by drawing air through Hi-Vol glass jars containing 125-ml of precleaned XAD-2® resin (Rohm and Haas). After sample collection, Hi-Vol jars were packaged, placed on dry ice, and remained at approximately -10°C for 1 day until analysis.

In Fresno County, air samples were collected on August 6, 13, and 19, 1991, at sites 10 and 13 (Figure 1). In Monterey County, air samples were collected on August 6, 13, and 20, 1991, at sites 9 and 15.

Mass Deposition

In addition to potted plants, mass deposition sheets were used to measure dry deposition of the pesticides. A mass deposition sheet consists of a 0.093-m^2 (9 X 16 inch) paper towel with plastic backing (Kimbie®,

Kimberley-Clark Corp.). Deposition sheets were set out at each monitoring site at the same time plants were deployed. All deposition sheets were collected the following week (August 7-9, 1991) and placed in a 0.5-L Mason jar and capped with a lid lined with aluminum foil. Deposition sheet samples were placed on dry ice and kept at approximately -10^{0}C for 2 days until analysis.

Sample Integrity

All personnel who collected samples wore disposable latex gloves that were changed between the collection of each sample medium. Scissors that were used to cut parsley and bell pepper plants were washed with a soap and water solution, rinsed twice with deionized water, and then rinsed again with isopropyl alcohol. Clean scissors were then sealed in clean polyethylene bags and placed in a storage box until next use.

Each sample was accompanied by a chain-of-custody (COC) form on which all sampling information was recorded (Appendix 1).

Chemical Analysis

Analytical methods for OPs and their respective oxygen analogs on parsley, bell pepper, XAD-2® resin, and mass deposition sheets were developed, and sample analyses conducted by the California Department of Food and Agriculture's Chemistry Laboratory Services, Sacramento, California. The OPs and their oxygen analogs were extracted from parsley and bell pepper plants with acetonitrile. The extract was filtered and the aqueous layer salted out with sodium chloride. The extract was evaporated to dryness, redissolved with acetone and analyzed using a Varian® 3700 gas

chromatograph (GC) equipped with a flame photometric detector (FPD), in the phosphorus ("P") mode. The XAD-2® resin samples were extracted with acetone. The solvent was evaporated to dryness, redissolved with acetone and analyzed by GC/FPD in the "P" mode. The OPs and oxygen analogs were extracted from mass deposition sheets with ethyl acetate, concentrated and analyzed by GC/FPD in the "P" mode. Detailed extraction procedures are presented in Appendix 2 and analytical method validation and continuing quality control results are presented in Appendix 3. Blank matrix spikes were used for method development. For continuous quality control during analysis, one blank matrix spike was analyzed with each extraction set for each matrix.

The minimum detectable level (MDL) for diazinon, chlorpyrifos, and parathion on parsley and bell peppers was 10 ug/kg. The MDL for diazoxon and paraoxon was 20 ug/kg; chlorpyrifoxon had a MDL of 30 ug/kg. All detectable OP and oxygen analog residues on plant material were presented on a wet weight basis. The MDL for these OPs in air was 0.2 ng/m^3. The MDL for diazoxon and paraoxon in air was 0.4 ng/m^3; chlorpyrifoxon had a MDL of was 0.6 ng/m^3. The MDL for these OPs and diazoxon and paraoxon on mass deposition sheets was 0.3 ug/0.09 m^2 while the MDL for chlorpyrifoxon was 0.5 ug/0.09 m^2.

RESULTS AND DISCUSSION

PESTICIDE USE

Pesticide use for the study areas, during the monitoring period from July 15 through August 30, 1991, are presented in Table 2. Chlorpyrifos had the highest use in both counties, followed by diazinon, and then parathion.

VEGETATION

Background residues of diazinon, chlorpyrifos, parathion or their oxygen analogs were below MDLs on samples of parsley and bell pepper plants. In addition, parathion and the oxygen analogs remained below MDLs after 2 and 4 weeks of exposure to air in Fresno and Monterey Counties. Residues of diazinon on parsley never exceeded the established tolerance of 750 ug/kg. In contrast, a tolerance level for chlorpyrifos on parsley has not been established.

Two Week Exposure

After 2 weeks exposure to air, diazinon and chlorpyrifos residues were detected on parsley in both counties (Table 3). In Fresno County, 41 ug/kg of diazinon was detected at 1 monitoring site while chlorpyrifos was detected at 3 sites with a maximum concentration of 31 ug/kg. In Monterey County, diazinon and chlorpyrifos were each detected at 2 sites, at a maximum concentration of 23 and 13 ug/kg, respectively. These data reveal that inadvertent residues can be detected on parsley within 2 weeks of exposure to air in the area where diazinon and chlorpyrifos are applied.

Table 2. Pesticide use from July 15, 1991, to August 30, 1991, for study areas in Fresno and Monterey Counties, California[a].

County	Amount Applied (kg ai)		
	Diazinon	Chlorpyrifos	Parathion
Fresno	20,988	28,180	2,541
Monterey	10,463	25,630	1,861

a. California Department of Food and Agriculture, 1991. Pesticide use report.

Table 3. Organophosphorus residues[a] on parsley foliage after 2 weeks exposure to air in Fresno and Monterey Counties in the summer of 1991.

Fresno Site	ug/kg (wet weight)		Monterey Site	ug/kg (wet weight)	
	Diazinon	Chlorpyrifos		Diazinon	Chlorpyrifos
01	ND[b]	ND	01	23	ND
04	ND	26	04	12	ND
07	ND	10	06	ND	ND
08	ND	ND	09	ND	13
12	ND	31	10	ND	ND
13	41	ND	11	ND	10
14	ND	ND	15	ND	ND

a. Diazoxon, parathion, paraoxon, and chlorpyrifoxon were not detected.
b. ND=not detected; minimum detectable level: diazinon, parathion, chlorpyrifos 10 ug/kg; diazoxon and paraoxon 20 ug/kg; chlorpyrifoxon 30 ug/kg.

Four Week Exposure

In Fresno County, of the 14 monitoring sites, diazinon residues and chlorpyrifos were detected on parsley at 3 sites each, with site 7 having residues of both OPs (Table 4). Concentrations ranged from 22 to 110 ug/kg for diazinon and 12 to 27 ug/kg for chlorpyrifos. Concentrations of diazinon were similar to those detected on potted dill plants (11-141 ug/kg) deployed in Stanislaus County by Turner et al. (1989). Only chlorpyrifos was detected on bell pepper plants and this occurred at site 7, at a concentration of 22 ug/kg.

In Monterey County, of the 15 monitoring sites, OP residues were detected only on parsley (Table 4). Diazinon was detected at 2 sites while chlorpyrifos was detected at 7 sites. Site 14 had residues of both OPs. Concentrations of diazinon were 60 and 99 ug/kg and chlorpyrifos residues ranged from 11 to 100 ug/kg. Again, these values are similar to those reported by Turner et al. (1989) on potted dill plants where the concentrations ranged from 11-141 ug/kg for diazinon and 33-282 ug/kg for chlorpyrifos.

One site (14) in Monterey County did not meet the original site selection criteria because an application of chlorpyrifos was made within the 0.4-km radius during the exposure period. Chlorpyrifos was applied by ground application equipment to broccoli, approximately 50-m west of the parsley plants. This application occurred on 16 August, 1991, 11 days before samples were collected and the detected concentration was 38 ug/kg. It is possible that this residue is from regional transport since diazinon was

Table 4. Organophosphorus residues[a] on parsley foliage after 4 weeks exposure to air in Fresno and Monterey Counties in the summer of 1991.

Fresno Site	ug/kg (wet weight) Diazinon	Chlorpyrifos	Monterey Site	ug/kg (wet weight) Diazinon	Chlorpyrifos
01	ND[b]	ND	01	99	37
02	ND	ND	02	ND	ND
03	110	ND	03	60	11
04	ND	ND	04	ND	100
05	ND	ND	05	ND	ND
06	ND	ND	06	ND	10
07	48	27	07	ND	ND
08	ND	ND	08	ND	24
09	ND	ND	09	ND	37
10	ND	12	10	ND	ND
11	ND	ND	11	ND	ND
12	ND	24	12	ND	15
13	22	ND	13	ND	ND
14	ND	ND	14[c]	28	38
			15	ND	ND

a. Diazoxon, parathion, paraoxon, and chlorpyrifoxon were not detected.
b. ND=not detected; minimum detectable level: diazinon, parathion, chlorpyrifos 10 ug/kg; diazoxon and paraoxon 20 ug/kg; chlorpyrifoxon 30 ug/kg.
c. This site received a chlorpyrifos application within the 0.4-km buffer.

also detected at this site, and no reported application of this OP occurred within the 0.4-km buffer zone.

It is uncertain why there was only one single detection of an OP on bell pepper plants. Chlorpyrifos was detected at site 7, on bell pepper, in Fresno County at a concentration of 22 ug/kg. There were no other detections for the parent compounds or their oxygen analogs on this medium. It is also inexplicable why the oxygen analogs were not detected on parsley. This study was not designed to determine trapping mechanisms of individual plant species. However, it is possible that residue concentrations might vary significantly for different species since surface characteristics and canopy structure are important in gas-phase deposition. Vegetation variables such as leaf surface morphology, non-uniformity of canopy, height above ground, and surface area and wetness can affect dry deposition rates (Sehmel, 1980).

The presence of OP residues on parsley plants in Fresno and Monterey Counties can be attributed to either particulate deposition on and/or absorption of vapor-phase pesticide by the plants. There were no known applications of these OPs made within 0.4 km of the monitoring sites, and yet diazinon or chlorpyrifos or both were detected on parsley at 12 of 29 sites (41 percent) for both counties after the 4-week exposure period. Residues on parsley must have come from sources greater than 0.4 km distant and in some cases, could have come from distances greater than 3.2 km (Figures 2, 3, 4, and 5). Glotfelty et al. (1990b) concluded that during the dormant spray season, diazinon in California's Central Valley atmosphere results from volatilization. Zabik and Seiber (1991) found that

Figure 2. Amount of diazinon applied per section (2.56 km²) from July 15 to August 30, 1991, and diazinon detections at plant monitoring sites in Fresno County, CA. Parsley plants were exposed from July 29 to August 26, 1991.

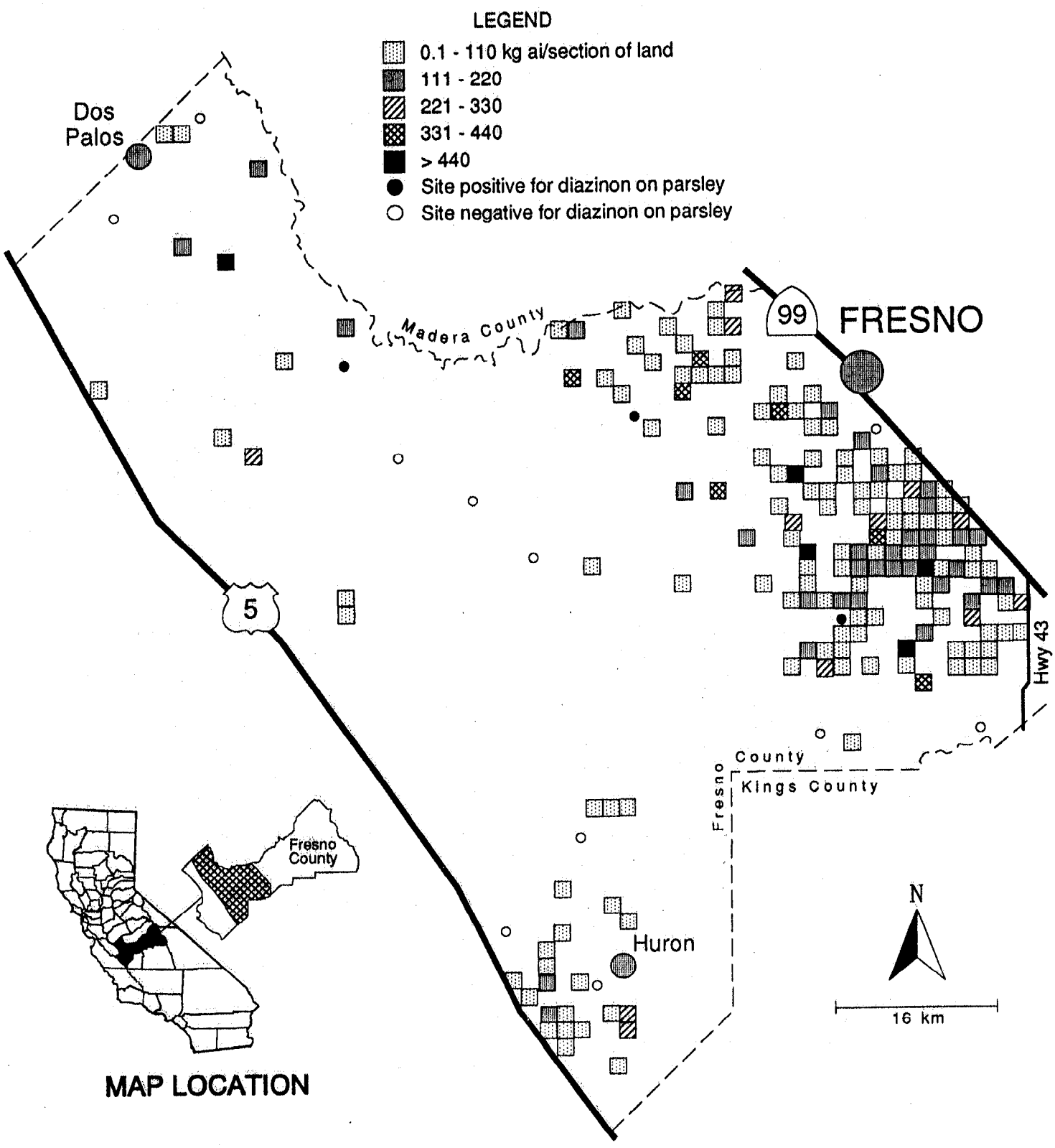


Figure 3. Amount of chlorpyrifos applied per section (2.56 km^2.) from July 15 to August 30, 1991, and chlorpyrifos detections at plant monitoring sites in Fresno County, CA. Parsley plants were exposed from July 29 to August 26, 1991.

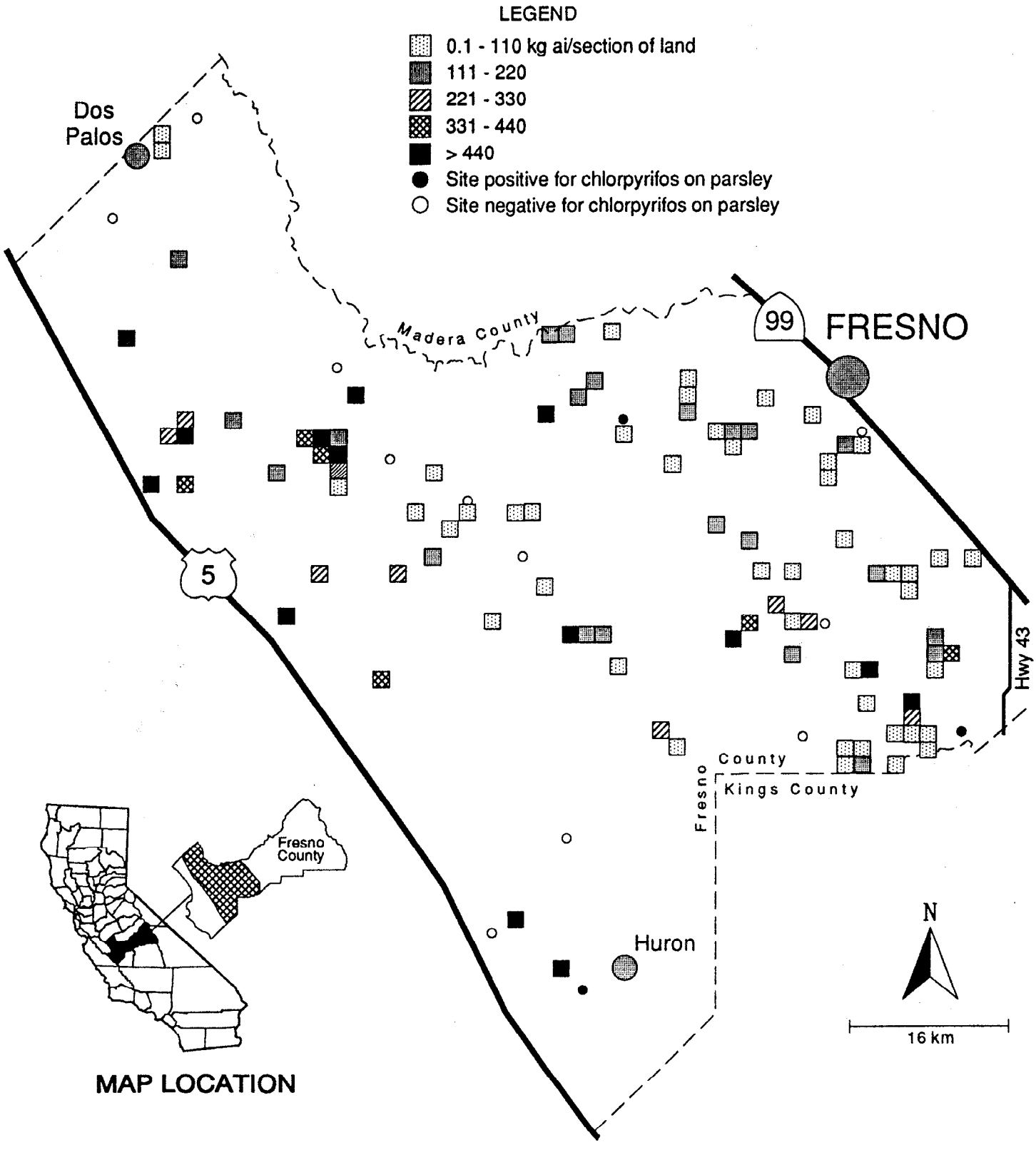
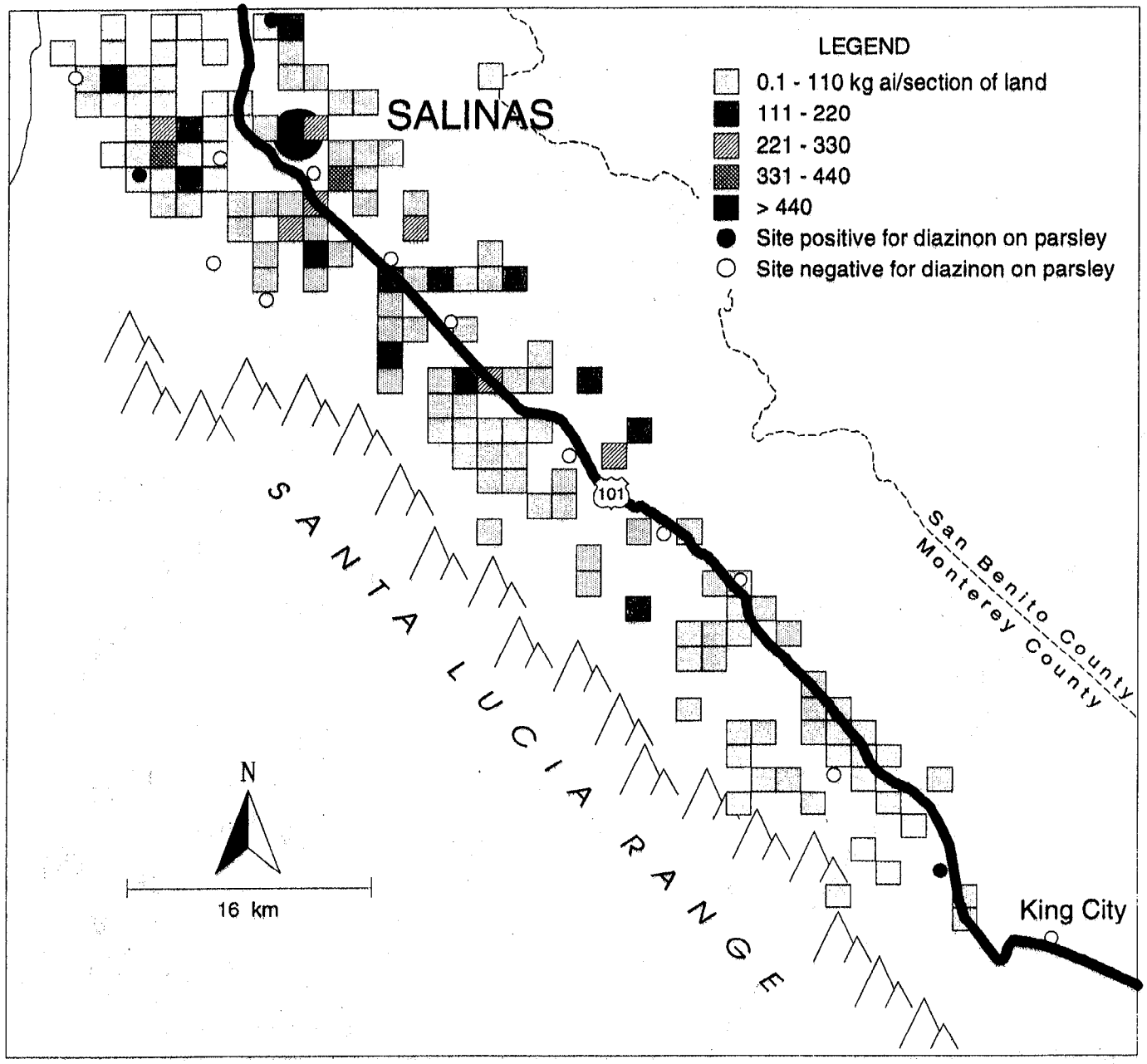
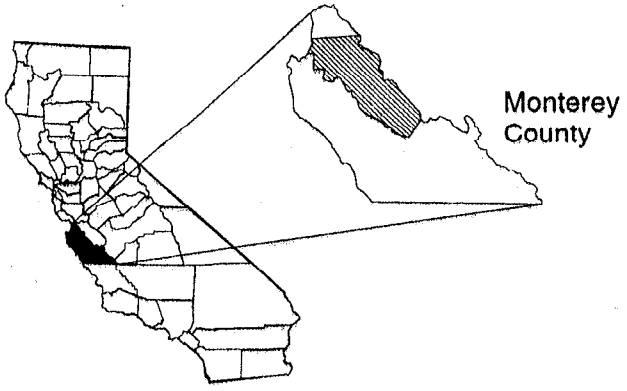


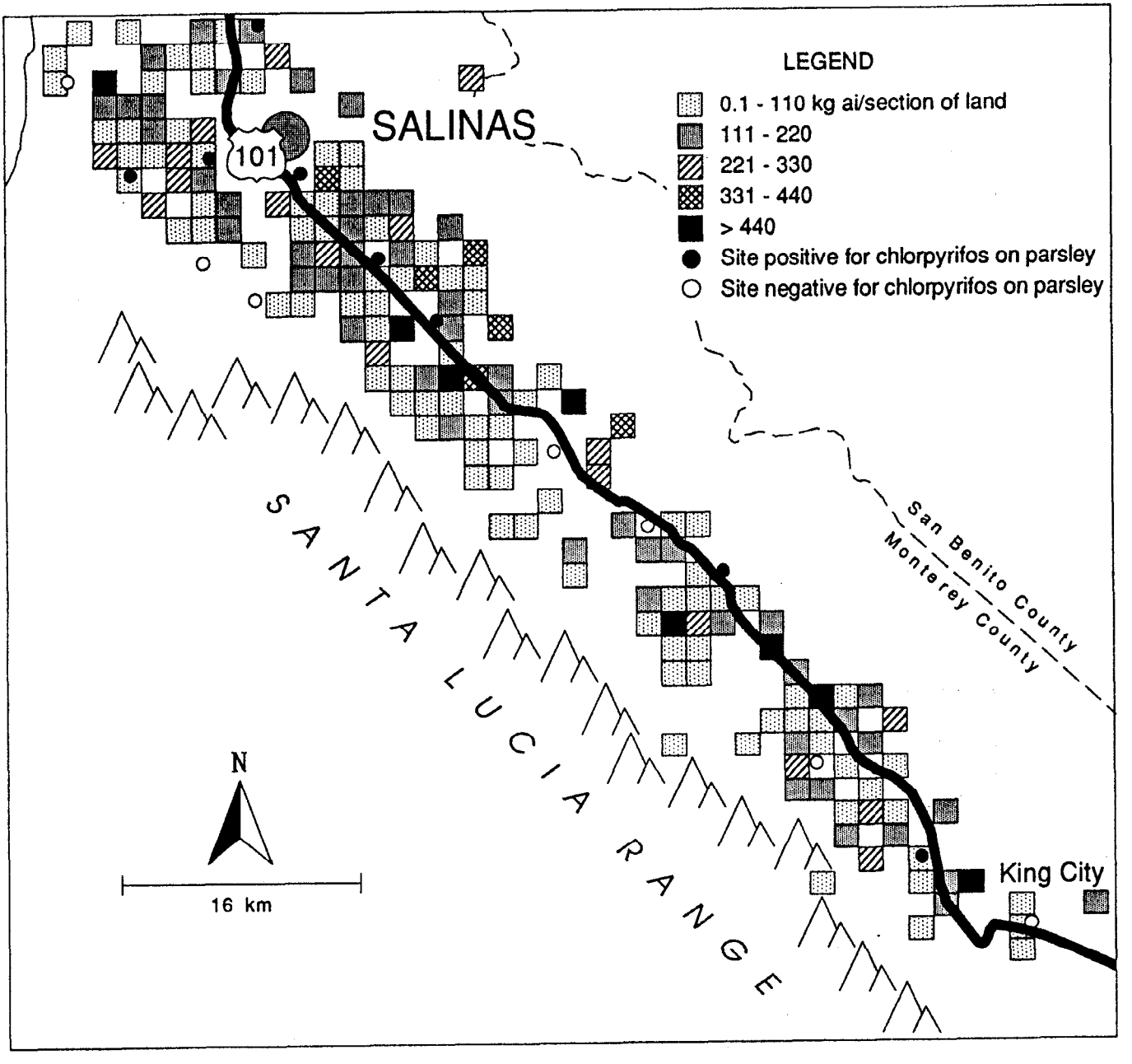
Figure 4. Amount of diazinon applied per section (2.56 km ^{2}) from July 15, to August 30, 1991 and diazinon detections at plant monitoring sites in Monterey County, CA. Parsley plants were exposed from July 31, to August 28, 1991.

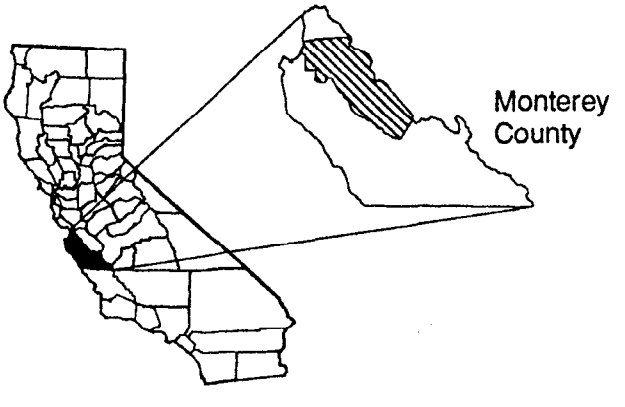




MAP LOCATION

Figure 5. Amount of chlorpyrifos applied per section (2.56 km^2) from July 15 to August 30, 1991, and chlorpyrifos detections at plant monitoring sites in Monterey County, CA. Parsley plants were exposed from July 31 to August 28, 1991.





MAP LOCATION

OPs were transported in the atmosphere from the Central Valley to the Sierra Nevada Mountains in California during December, January and February. Therefore, long-range transport of pesticides has been reported previously in California.

Air currents probably influenced pesticide movement and subsequent redeposition. During June, July, and August, in the San Joaquin Valley (Fresno County) the winds are from the north 90 percent of the time, while northwest winds predominate in the Salinas Valley region of Monterey County (Hayes et al., 1989). Diurnal patterns show that the wind can change or reverse direction throughout the 24-hour cycle. Most positive detections in this study were either down-wind of sections with greater than 110 kg active ingredient (ai) of OPs applied, or they were encompassed by several sections of land where these OPs were applied (Figures 2,3,4, and 5). These data suggest a relationship between general air movement patterns and OP deposition on non-target vegetation.

AIR SAMPLES

Fresno County

Diazinon, chlorpyrifos, parathion, and diazoxon were detected in ambient air samples collected in Fresno County. These OPs were detected in 4 of the 6 total air samples collected at the 2 monitoring sites (Table 5). Chlorpyrifoxon and paraoxon were not detected.

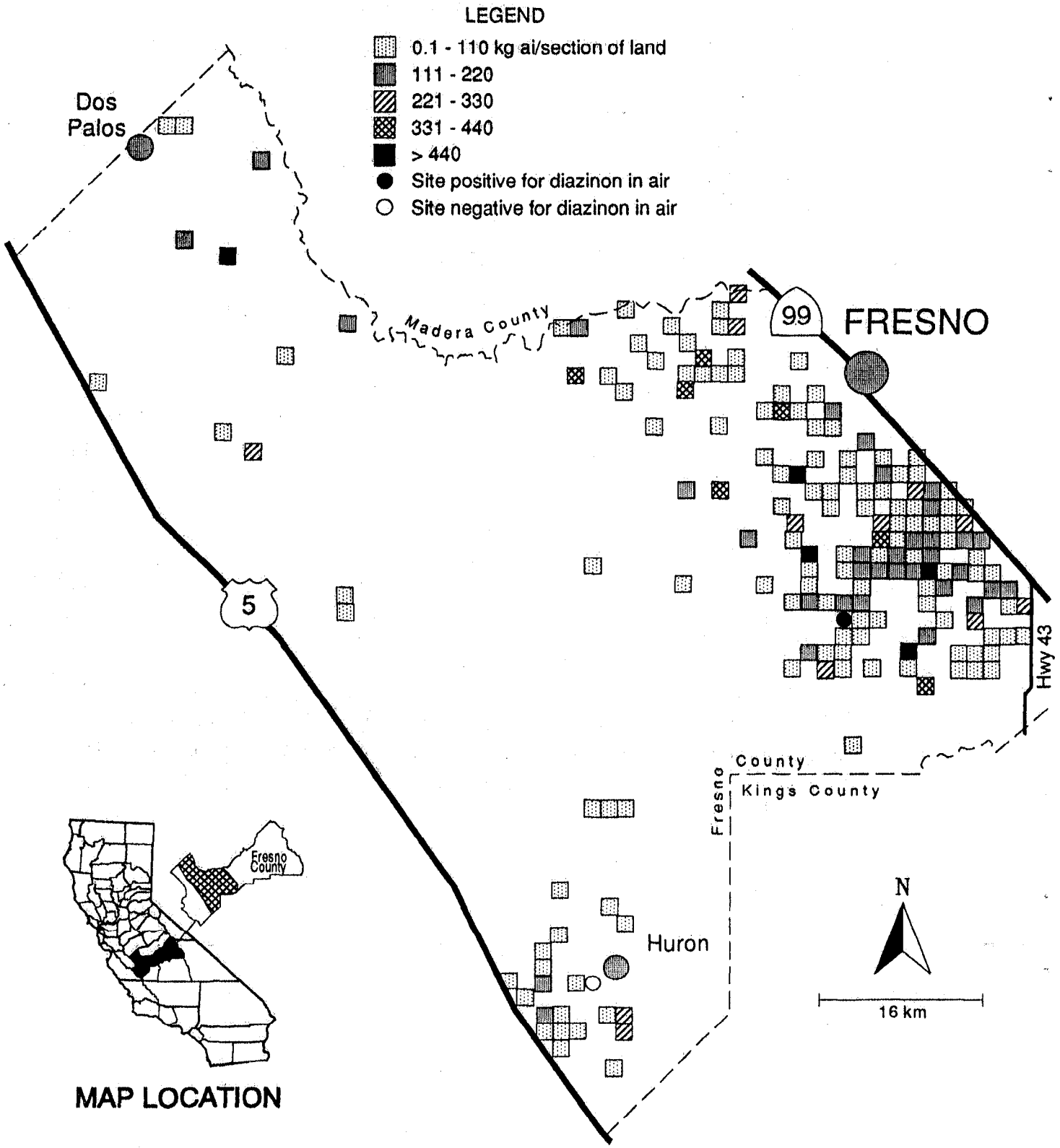
Diazinon was not detected at site 10 but was found in all 3 samples collected at site 13, where concentrations ranged from 0.3 to 35.7 ng/m^3. The lack of diazinon detections at site 10 might be attributed to fewer

Table 5. Organophosphorus residues detected in air sampled in Fresno and Monterey Counties in the summer of 1991.

Site	Sample Date	Concentration (ng/m^3) Diazinon	Diazoxon	Parathion	Paraoxon	Chlorpyrifos	Chlorpyrifoxon
Fresno							
10	8/06	ND[a]	ND	ND	ND	ND	ND
10	8/13	ND	ND	ND	ND	0.3	ND
10	8/19	ND	ND	ND	ND	ND	ND
13	8/06	0.3	ND	ND	ND	ND	ND
13	8/13	35.7	73.2	ND	ND	0.5	ND
13	8/19	10.2	9.1	0.3	ND	1.1	ND
Monterey							
09	8/06	0.3	ND	ND	ND	0.8	ND
09	8/13	0.2	ND	ND	ND	23.1	13.7
09	8/20	0.4	ND	ND	ND	26.3	9.4
15	8/06	ND	ND	ND	ND	0.5	ND
15	8/13	0.4	1.0	0.6	0.6	1.0	0.9
15	8/20	ND	ND	0.2	ND	0.4	ND

a. ND=not detected; method detection limit: diazinon, parathion, chlorpyrifos 0.2 ng/m^3; diazoxon, paraoxon 0.4 ng/m^3; chlorpyrifoxon 0.6 ng/m^3.

Figure 6. Amount of diazinon applied per section (2.56 km²) from July 15 to August 30, 1991, and air monitoring sites on August 6, 13, and 19, 1991, in Fresno County, CA.

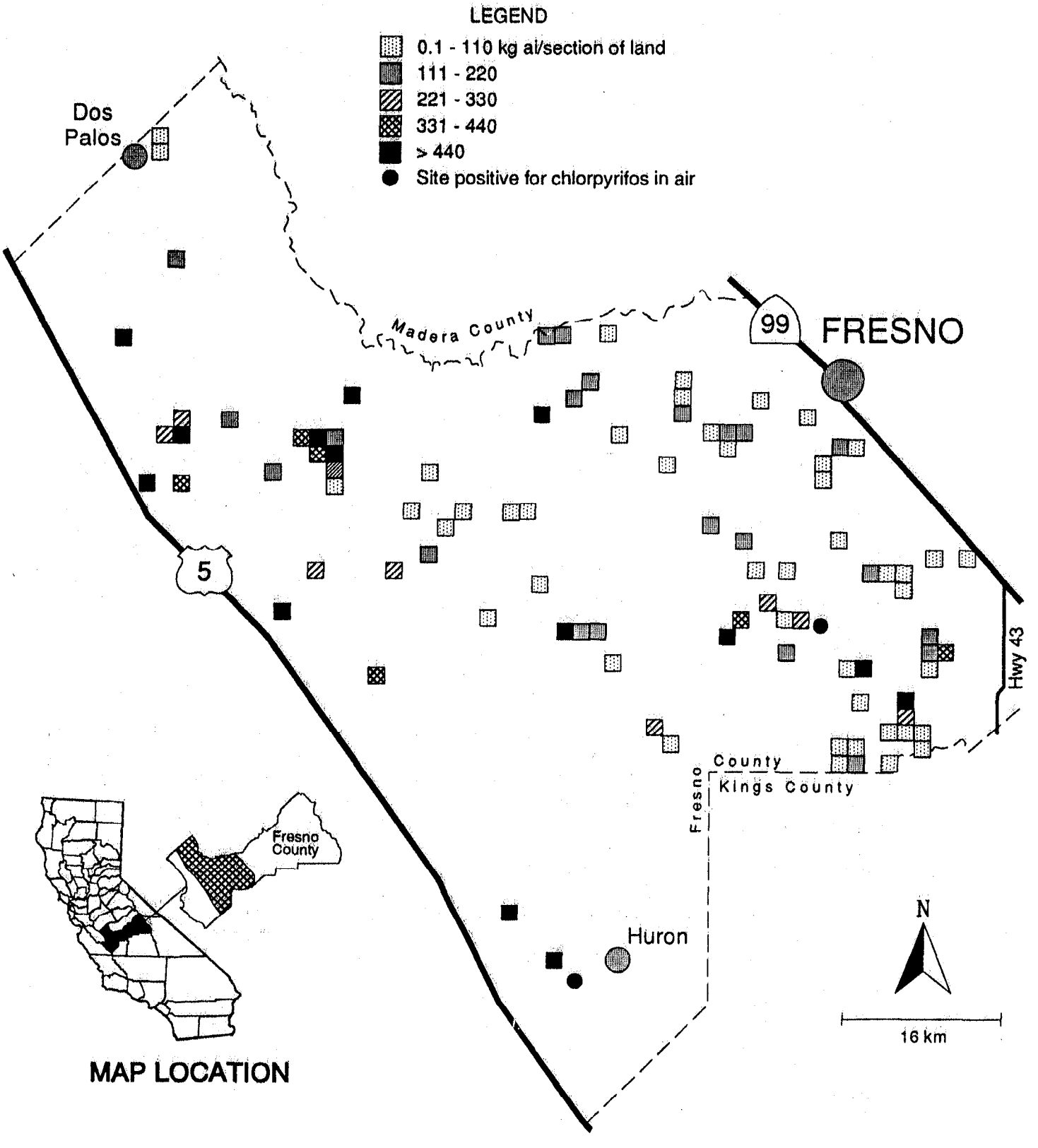


applications of pesticide in the vicinity (Figure 6) and wind direction. The plant samples collected from site 10 also did not contain diazinon. Only 4 sections of land within an 8-km radius of site 10 were treated with diazinon between August 5 and 20, 1991. All other applications within the 8-km radius occurred after the last air sample was collected.

Diazoxon was present in 2 samples collected at site 13, at 9.1 and 73.2 ng/m^3. These concentrations were high relative to parent residues and this could have been caused by artificial conversion of the parent product to the oxygen analog during sample collection. It has been demonstrated that artificial conversion of parathion occurs in-sampler (Woodrow et al., 1977). Segawa et al. (1990) demonstrated that another OP, malathion, can be artificially converted to malaoxon. Conversion of OPs to their oxygen analogs can also occur in air due to the presence of hydroxy (OH) radicals (Winer and Atkinson, 1990). Since none of the oxygen analogs were detected on vegetation samples, it is possible that artificial conversion occurred in the sampler.

Chlorpyrifos was detected once at site 10 (0.3 ng/m^3) and twice at site 13, at 0.5 and 1.1 ng/m^3. This might be attributed to pesticide use patterns (Figure 7) and air movement. At site 10, a known application of chlorpyrifos occurred 1 mile northwest of the monitoring site 4 days prior to collection of the positive air sample. At site 13, chlorpyrifos applications occurred in the vicinity of the monitoring site 1 to 2 days prior to collecting positive air samples. Although air movement in the San Joaquin Valley (Fresno County) is predominately from the north, diurnal patterns indicate that the wind direction can change within the 24-hour

Figure 7. Amount of chlorpyrifos applied per section (2.56 km²) from July 15 to August 30, 1991, and air monitoring sites on August 6, 13, and 19, 1991, in Fresno County, CA.



cycle. These data suggest that gas- and/or particle-phase chlorpyrifos was collected and that this was not a result of drift during application. Seiber et al. (1989) also found chlorpyrifos (4.5-114 ng/m^3) in ambient air samples collected during June and July, 1987, in Kern County, California.

Parathion was not detected at site 10 but was detected once at site 13 at a concentration of 0.3 ng/m^3 (Figure 8). Parathion was not applied in the study area between August 6 and 21, 1991. There were no detections of parathion in air samples collected on August 6 and 13, yet one sample collected on August 19 was positive. It is uncertain why parathion was detected 13 days after a known application. It is possible that there was a non-reported use of the product or that an application was not recorded in the proper location. However, Zabik (1991) demonstrated that residues of parathion applied in the Central Valley could be detected in the Sierra Nevada Mountains. Therefore, it is also possible that parathion was applied outside the study area and gas- and/or particle-phase parathion moved into the vicinity.

Monterey County

In Monterey County, OPs were detected in all 6 air samples (Table 5) while the oxygen analogs were detected in 3 samples. Air-sampling results suggested that the residues detected were at sites located adjacent to or downwind from reported agricultural applications of these OP's.

Diazinon was detected in 4 of 6 samples and the concentrations ranged from 0.2 to 0.4 ng/m^3; diazoxon was detected only once. Diazinon was detected in all 3 samples collected at site 9 and was detected once at site 15

Figure 8. Amount of parathion applied per section (2.56 km²) from July 15 to August 30, 1991, and air monitoring sites on August 6, 13, and 19, 1991, in Fresno County, CA.

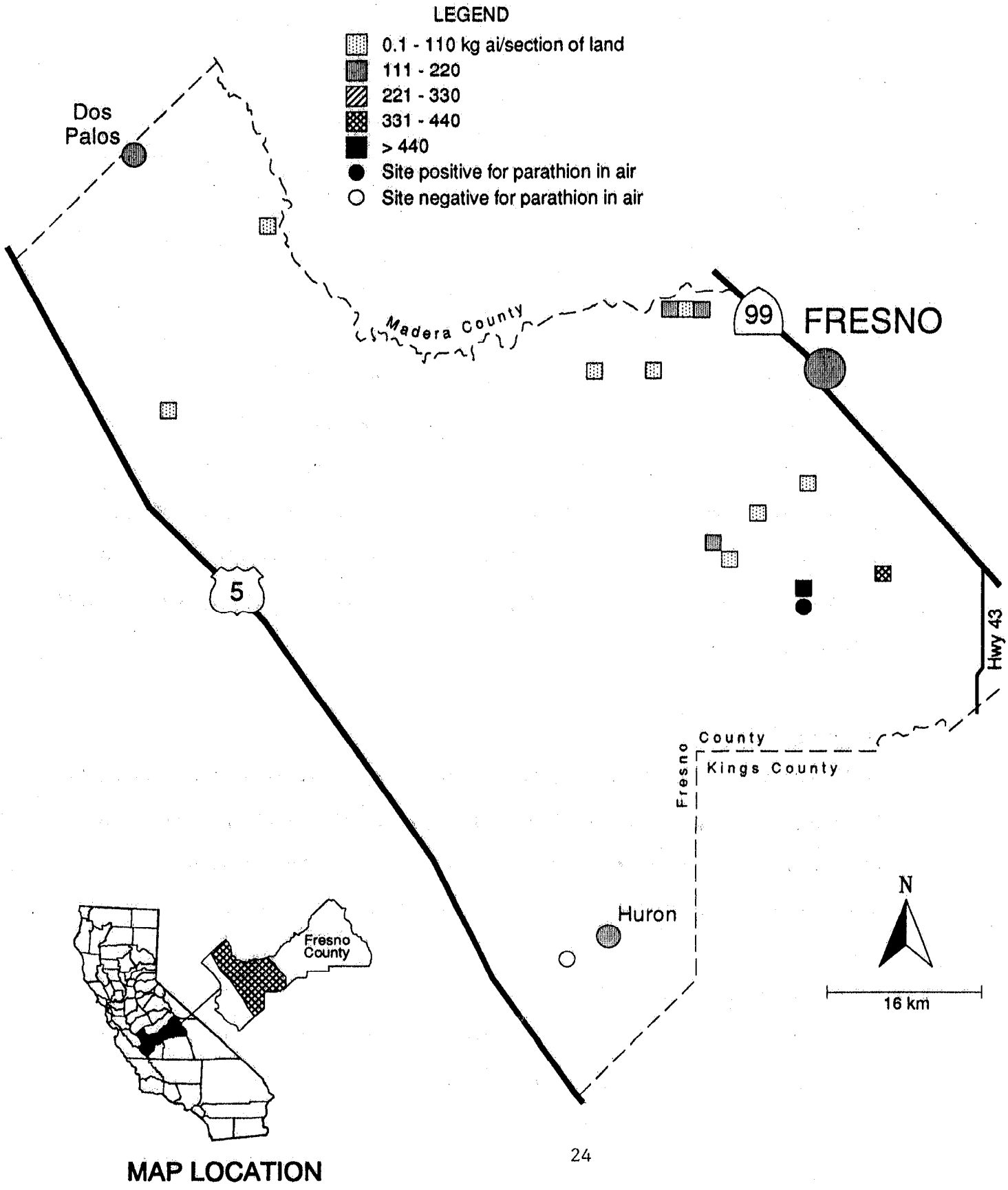
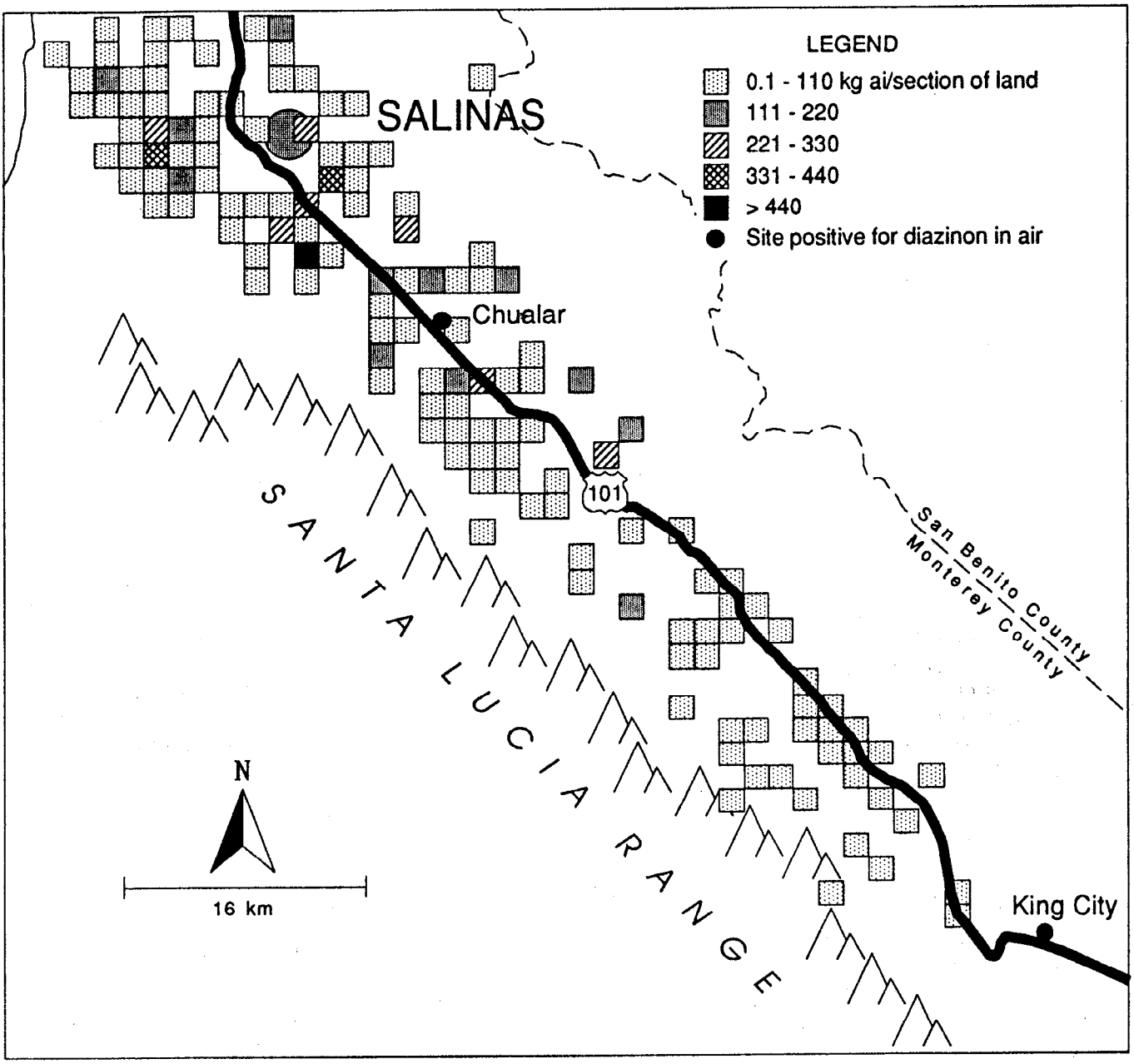
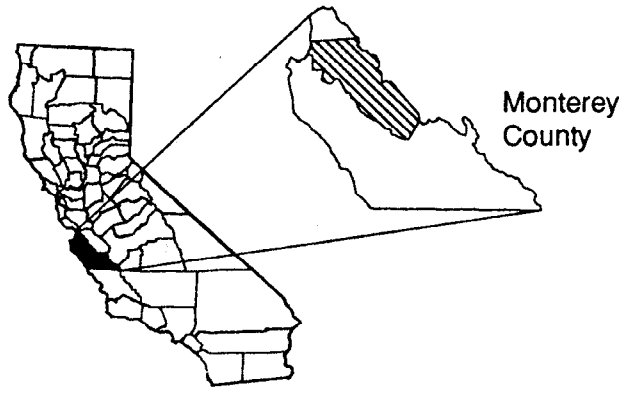


Figure 9. Amount of diazinon applied per section (2.56 km^2) from July 15 to August 30, 1991, and air monitoring sites on August 6, 13, and 20,1991, in Monterey County, CA.





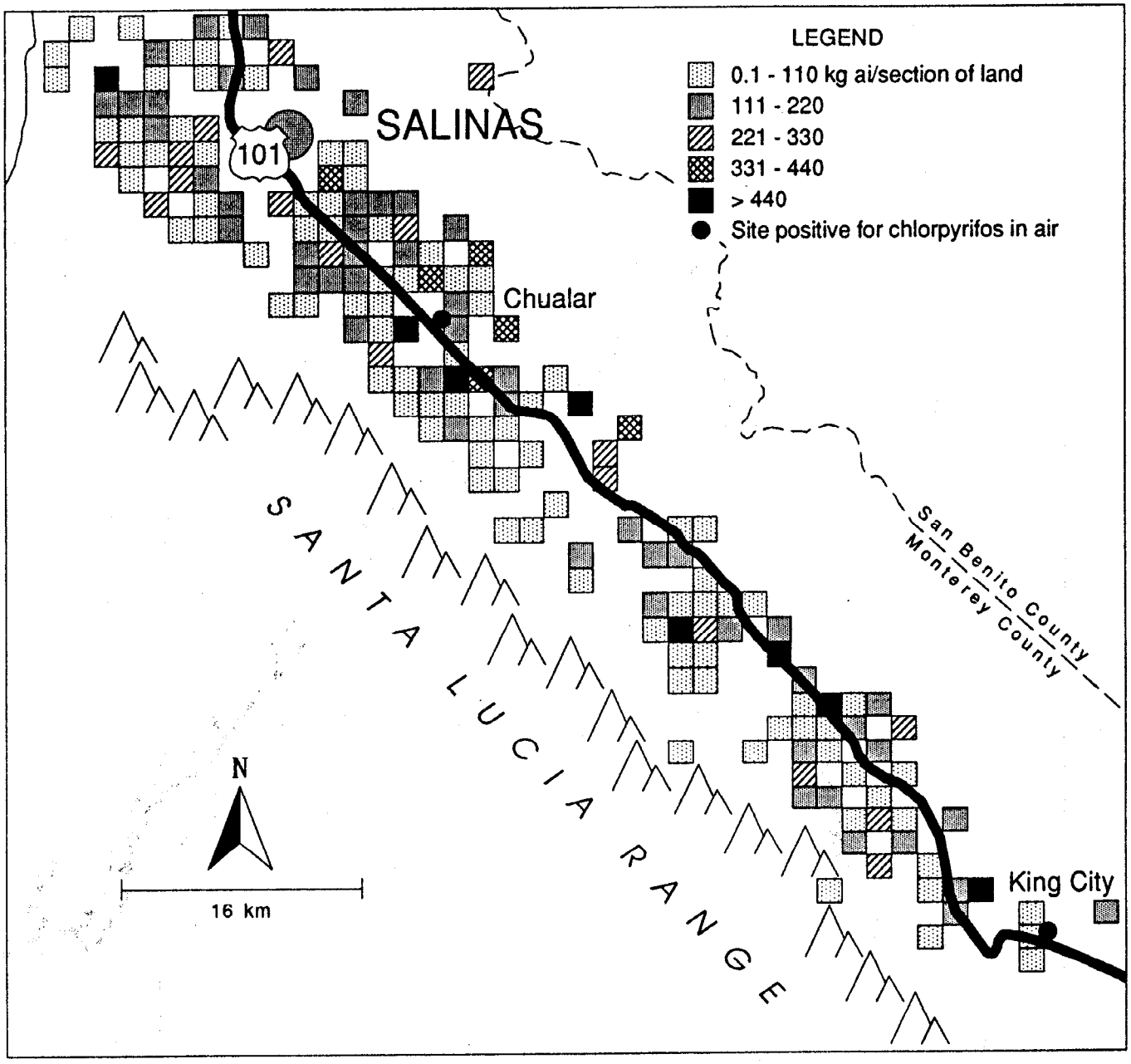
MAP LOCATION

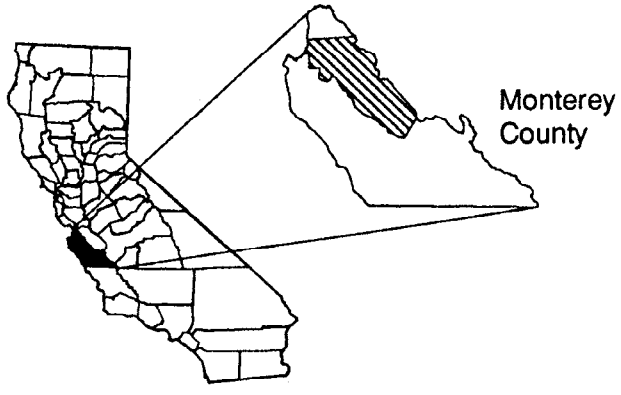
(Figure 9). This might be attributed to fewer applications of pesticide in the vicinity of site 15. Only two applications occurred near site 15 (4 km northwest) 2 to 4 days prior to detecting this OP while diazinon was regularly applied in the vicinity of site 9. Data from site 15 again suggest that gas-phase or particle-phase pesticide from post-application drift can be detected in air samples collected at distances up to 4 km away from application sites.

Chlorpyrifos was detected in all 6 samples and the concentrations ranged from 0.4 to 26.3 ng/m^3. Application of this OP occurred on the same day, as well as different days, when air samples were collected (Figure 10). However, same day applications were greater than 8 km away from the monitoring sites. Chlorpyrifos applied within 8 km of the sample sites occurred 1 to 4 days prior to detecting residues in air. Therefore, these positive detections might be attributed to both pesticide movement after and drift during application.

Parathion was detected in 2 samples at site 15, and the concentrations were 0.2 and 0.6 ng/m^3. These residues were detected in the vicinity of reported applications (Figure 11). Several sections northwest of site 15 received parathion applications between 6 and 23 August, 1991. Parathion was detected in air samples collected 1 to 6 days after these applications. Parathion applications occurred in the northern part of the Salinas Valley but they were either at distances greater than 16 km from site 9 or applied before August. These data suggest that general wind patterns, distance to monitoring sites, and time after application influence the ability to detect parathion in air.

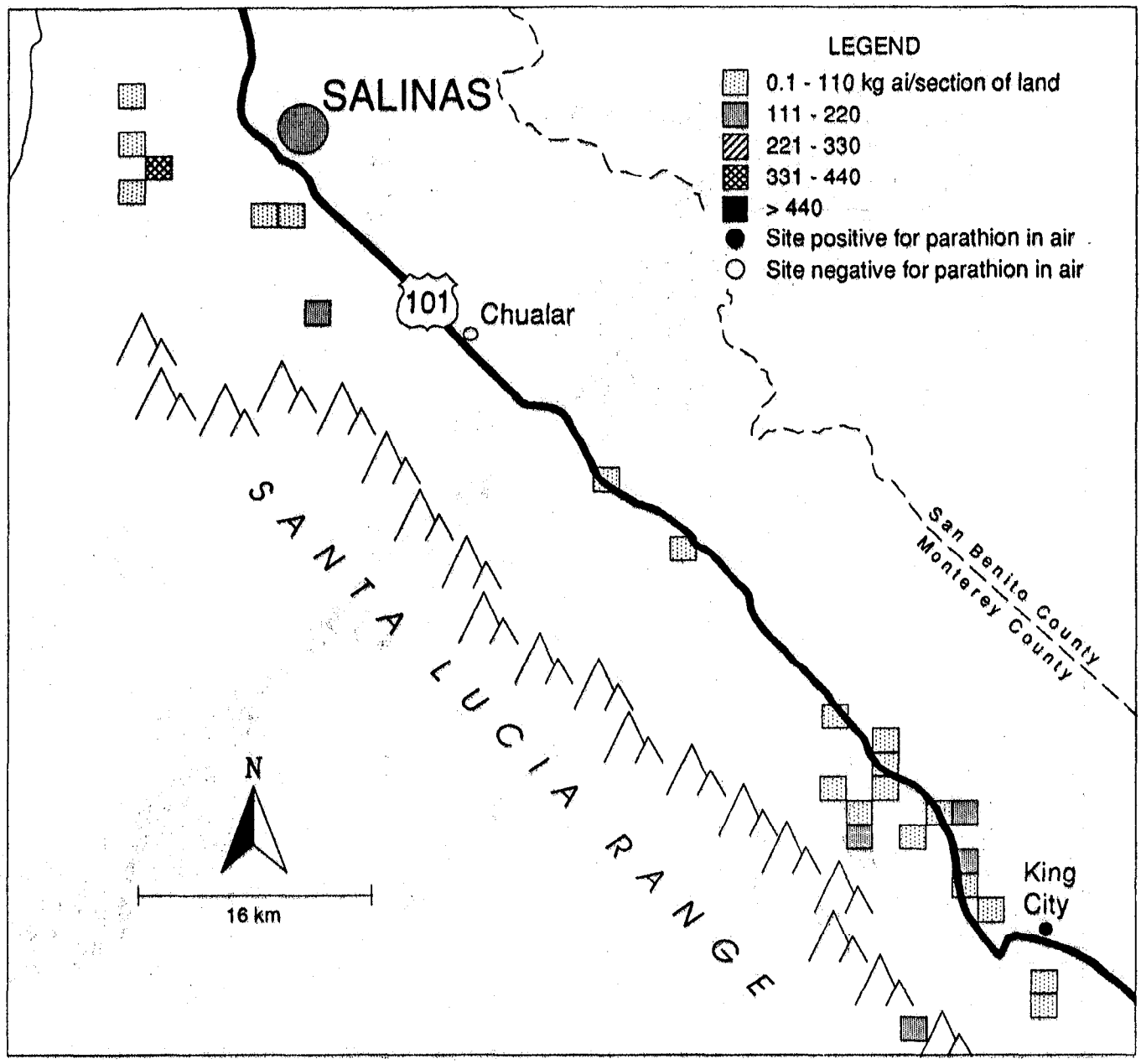
Figure 10. Amount of chlorpyrifos applied per section (2.56 km²) from July 15 to August 30, 1991, and air monitoring sites on August 6, 13, and 20, 1991, in Monterey County, CA.

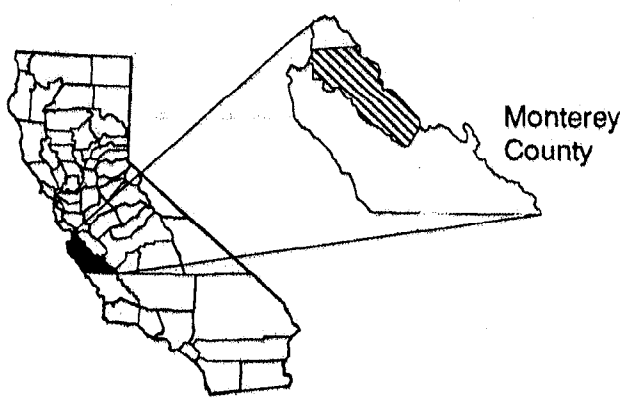




MAP LOCATION

Figure 11. Amount of parathion applied per section (2.56 km²) from July 15 to August 30, 1991, and air monitoring sites on August 6, 13, and 20, 1991, in Monterey County, CA.





MAP LOCATION

MASS DEPOSITION SHEETS

No OP residues or their oxygen analogs were detected on any of the 29 mass deposition sheets after one week of exposure to ambient air. These results suggest that this sample medium may not be appropriate for regional transport studies, at least not when deployed for a one week period. Although Turner et al. (1989) showed that dry deposition can be measured on mass deposition sheets within four hours of exposure to ambient air, this might have been due to local fog events.

CONCLUSIONS

The presence of all 3 OPs and oxygen analogs in ambient air samples and residues of diazinon and chlorpyrifos on parsley demonstrated that regional aerial movement and deposition of organophosphorus pesticides occurred in Fresno and Monterey Counties, California. These results suggest that economic loss could occur if inadvertent pesticide residues are regionally transported from an agricultural application site onto crops which do not have established tolerances for the pesticide. The lack of quantifiable residues on parsley at some sites indicate pesticide movement or deposition may be influenced by factors such as wind and proximity of the pesticide application to the monitoring sites.

In addition, bell pepper plants and mass deposition sheets appear to be inefficient surfaces to capture gas or particle deposition of these OPs and their oxygen analogs. It is possible that morphological characteristics of bell pepper plants inhibit dry deposition. The lack of detections on mass deposition sheets may have been influenced by physical characteristics of

the Kimbie, the length of exposure time, as well as the photostablity of the compounds.

Since regional transport of inadvertent OP residues can occur on non-target crops during the summer months, research appears warranted to determine which factors influence pesticide movement during this time of year. Future research concerning off-site movement might include examining factors which can be controlled such as 1) applying different pesticide formulations and measuring subsequent off-site movement; 2) using different application methods under varying meteorlogical conditions and documenting the mass of pesticide moving off-site; and 3) using tracer analysis to facilitate the determination of the pesticide source and distance of pesticide movement.

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APPENDIX 1

Sample Chain-of-Custody

STATE OF CALIFORNIA
DEPARTMENT OF FOOD
AND AGRICULTURE

Form 30-023 (7/91)

CHAIN OF CUSTODY RECORD
(use ball point pen only)

Summer OP Study

ENVIRON. MONITOR. & PEST MGMT.
ENVIRON. HAZARDS ASSESSMENT
1220 N STREET, ROOM A-149
SACRAMENTO, CA 95814

Study #	Sample#	County Code	Location Code	Twn	Range	Sec	Vegetation Sample: Date Sampled Mo	Day	Yr	Time	Days Exposed	Plant Type
1 1 0												
1 2 3 4 5	6 7 8 9	10 11	12 13	14 15 16	17 18 19	20 21	22 23	24 25	26 27	28 29 30 31	32 33	34 35 36 37 38 39 40

Hi Vol Air Sample: Date On Mo	Day	Yr	Time	Date Off Mo	Day	Yr	Time	Flow Rate L/Min	Person Collecting		Lab Code
41 42 43 44 45	46 47 48 49 50	51 52 53	54 55 56	57 58 59 60	61 62 63 64	65 66	67 68 69 70 71	72 73 74	75 76	77 78 79 80	

Partner: Owner:

Hi Vol #: Address:

Remarks:

KEY

Col. 2
* = Split Sample

Col. 10-11 County Code
Fresno = 10
Kern = 15
Monterey = 27

Col. 12-13 Location Code
01-14

Col. 34-40 Plant Type
Parsley
Pepper

Col. 77-80 Lab Code
CDFA = 4323
CAL = 9527

Lab Results: (Save Extracts)

CHEMICAL	AMOUNT	DETECTION LIMIT
Diazinon		
Diazoxon		
Parathion		
Paraoxon		
Chlorpyrifos		
Chlorpyrifos O.A.		
Wet Weight		
% Moisture		

Extracted by: Extraction Date:

Analyzed by: Analysis Date:

Approved by: Report Date:

Task / Container Prepared	Relinquished by	Received by	Date/Time

Lab Name	Received for by lab	Date/Time	Logged in by	Date/Time	Lab #

Distribution : White to CDFA lab liaison, Yellow retained by lab, Pink to field files. EM/PM 6

APPENDIX 2

Analytical Methods

CALIFORNIA DEPT. OF FOOD & AGRIC.
CHEMISTRY LABORATORY SERVICES
ENVIRONMENTAL MONITORING SECTION
3292 Meadowview Road
Sacramento, Ca 95832
(916) 427-4649/4999

Original Date: 06/9/89
Supercedes: New
Current Date: 09/17/91
Method #:

DIAZINON, CHLORPYRIFOS, ETHYL PARATHION AND THEIR OXYGEN ANALOGS ON PARSLEY AND GREEN PEPPER

SCOPE:

This method is for the determination of Diazinon, Chlorpyrifos, Ethyl Parathion and their oxygen analogs on parsley and green pepper.

PRINCIPLE:

Residues of Diazinon, Chlorpyrifos, Ethyl Parathion and their oxygen analogs were extracted from parsley and green pepper samples by blending with acetonitrile. The extract was filtered and the aqueous layer salted out with sodium chloride. An aliquot of the organic layer was evaporated to dryness. The residue was brought up to volume with acetone and analyzed by gas chromatograph using a flame photometric detector(FPD).

REAGENTS AND EQUIPMENT:

Solvent; (pesticide residue grade) acetonitrile and acetone.
Sodium chloride.
Whatman #1 filter paper.
Waring® stainless steel blender (1 quart).
Nitrogen evaporator (Organomation N-EVAP Model # 12).
Cusinart® food processor (Model DLC 7).
Dry ice.

ANALYSIS

1) Grind the sample in a Cusinart with dry ice until the sample becomes homogeneous.

2) Transfer the ground sample to a mason jar. Apply lid loosely to allow carbon dioxide to escape. Store in freezer overnight.

3) Take 50 gms of ground sample from freezer and place in a 1 quart Waring blender. Blend with 100 mL acetonitrile for a minute at high speed.

4) Filter sample through Whatman #1 filter paper into a 100 mL graduate mixing cylinder containing approximately 10 g of sodium chloride. Stopper cylinder and shake vigorously for approximately 60 sec. Let stand for a

few minutes to allow acetonitrile and water layers to separate.

5) Pipet a 10 ml aliquot of acetonitrile layer into a 15 ml test tube. CARE: Evaporate extract <u>just to dryness</u> on a nitrogen evaporator. Redissolve in acetone to a final volume of 1.0 ml. Submit sample for gas chromatographic analysis.

EQUIPMENT CONDITIONS:

VARIAN 3700 GC WITH FPD "P" mode
COLUMN: HP 17 (50% phenyl methyl silicone) 10 m x 0.53 mm x 2.00 um.
CARRIER GAS: Helium, flow rate: 15 mL/min.
INJECTOR: 210°C,
DETECTOR: 250°C;
TEMPERATURE PROGRAM: Initial Temp: 150°C held for 1 minutes;
Rate: 10°C per minute.
Final Temp: 220°C held for 4 minutes;
Injection volume: 2 uL
Retention times: Diazinon 3.76 ± 0.05 min.
Diazinon OA 3.87 ± 0.05 min.
Ethyl Paraoxon 5.50 ± 0.05 min.
Chlorpyrifos 5.62 ± 0.05 min.
Ethyl Parathion 5.86 ± 0.05 min.
Chlorpyrifos OA 5.90 ± 0.05 min.

VARIAN 3700 GC WITH FPD "P" mode
COLUMN: DB 210 (50% tri-fluoropropyl methyl polysiloxane) 15 m x 0.53 mm x 1.00 um.
CARRIER GAS: Helium, flow rate: 16 mL/min.
INJECTOR: 220°C,
DETECTOR: 250°C;
TEMPERATURE PROGRAM: Initial Temp: 150°C held for 1 minutes;
Rate: 20°C per minute.
Final Temp: 220°C held for 4 minutes;
Injection volume: 2 uL
Retention times: Diazinon 0.91 ± 0.05 min.
Diazinon OA 1.59 ± 0.05 min.
Chlorpyrifos 1.73 ± 0.05 min.
Chlorpyrifos OA 2.67 ± 0.05 min.
Ethyl Parathion 2.81 ± 0.05 min.
Ethyl Paraoxon 3.20 ± 0.05 min.

CALCULATIONS:

$$\% \text{ Moisture} = \frac{(\text{weight of undried sample + pan}) - (\text{weight of dried sample + pan})}{(\text{weight of undried sample + pan}) - (\text{weight of pan})} \times 100$$

PPM Diazinon, Chlorpyrifos, Ethyl Parathion and their Oxygen Analogs

Undried parsley and peppers

$$ppm = \frac{(\text{peak height sample}) \times (\text{ng std}) \times (\text{final volume ml})}{(\text{peak height standard}) \times (\text{ul sample injected}) \times (\text{sample weight})}$$

RECOVERIES:

% Recoveries of Diazinon, Chlorpyrifos, Ethyl Parathion and their oxygen analogs at these levels:

PEPPER

Levels	0.03ppm (Mean)	(SD)	0.05ppm (Mean)	(SD)	0.20ppm (Mean)	(SD)	1.0ppm (Mean)	(SD)
Diazinon (n=2)	100	4.24	102	11.31	115	0	102	2.12
Diazinon OA (n=2)	110	4.24	89	4.24	118	3.53	104	0.71
Chlorpyrifos (n=2)	97	13.43	98	11.31	118	3.53	108	0
E. Parathion (n=2)	102	7.07	100	14.14	115	7.07	110	0.71
E. Paraoxon	105	2.12	87	1.41	123	3.53	98	4.24

PARSLEY

Levels	0.03ppm (Mean)	(SD)	0.05ppm (Mean)	(SD)	0.20ppm (Mean)	(SD)	1.0ppm (Mean)	(SD)
Diazinon (n=2)	102	2.12	98	5.56	110	7.07	94	0.71
Diazinon OA (n=2)	100	0	95	7.07	107	10.60	95	0.71
Chlorpyrifos (n=2)	103	0	97	1.41	100	0	90	1.41
E. Parathion (n=2)	103	4.24	99	1.41	103	3.53	94	0
E Paraoxon (n=2)	100	0	94	0	110	0	101	0

MINIMUM DETECTABLE LEVEL:

The minimum detectable level was 0.01 ppm for the parents and 0.02 ppm for Diazinon OA and Ethyl Parathion. (50 grams undried sample extracted without moisture correction.) Due to a consantly quite baseline a S/N=3 was obtained.

DISCUSSION:

Chlorpyrifos OA standard was able to be chromatographed, but in the pepper and parsley matrix some problems occur. The matrix deteriorates the insert and column very rapidly making it unable to get a consistent response for Chlorpyrifos OA. Changing the insert and trimming the column helps, but as time goes on the insert has to be changed after almost every sample, making it unpractical. More work is planned to overcome this problem.

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CALIFORNIA DEPT. OF FOOD & AGRIC.
CHEMISTRY LABORATORY SERVICES
ENVIRONMENTAL MONITORING SECTION
3292 Meadowview Road
Sacramento, Ca. 95832
(916) 427-4649/4999

Original Date: 06/09/89
Supercedes: New
Current Date: 09/17/91
Method #:

DIAZINON, CHLORPYRIFOS, ETHYL PARATHION AND THEIR OXYGEN ANALOGS IN HIGH VOLUME AIR SAMPLER RESIN

SCOPE:

This method is for the determination of Diazinon, Chlorpyrifos, Ethyl Parathion and their Oxygen Analogs in high volume air samplers containing XAD-2® resin.

PRINCIPLE:

Diazinon, Chlorpyrifos, Ethyl Parathion and their Oxygen Analogs were extracted from XAD-2® resin with acetone. The solvent was rotary evaporated to dryness and the residues were brought to a final volume with acetone. The extract was analyzed using gas chromatography and a flame photometric detector (FPD).

REAGENTS AND EQUIPMENT:

Acetone; (pesticide residue grade)
Ultrasonic bath (Branson B72).
Chromatographic columns (19 mm by 500 mm Kimble).
Boiling flasks, flat bottom with ground glass joint 24/40 (500 mL).
Wide-mouth mason jars (pint size).
Rotary evaporator (Büchi/Brinkmann, R110).
Graduate test tubes (15 mL).
Nitrogen evaporator (Organomation Model # 12).
Vortex mixer for test tubes.
XAD-2® (Rohm and Haas);hexane-acetone soxhlet washed.

ANALYSIS:

1) Empty resin from the high volume air sampler into a wide mouth mason jar.

2) Add 150 mL of acetone to the mason jar. Cover the jar with foil and cap. Place it into an ultrasonic bath for 30 minutes.

3) Pour solvent and resin into a 19 mm diameter by 500 mm long chromatography column with a glass wool plug at the outlet end.

4) Allow solvent to flow from the column at a rate of 2-3 mL/minute into a 500 mL boiling flask.

5) Rinse the mason jar from step #1 with 100 mL of acetone; pour the solvent and any remaining resin into the column.

6) Allow solvent to elute into the same flask as before.

7) Elute column with an additional 50 mL of acetone.

8) Rotary evaporate the extract just to dryness at 35°C at approximately 20 mm Hg vacuum.

9) Add 1 mL of acetone to the flask. Then transfer the extract to a calibrated test tube. Wash the flask 3 times each with 2 mL of acetone. Transfer each wash to the same graduated test tube.

10) Place extract on a nitrogen evaporator with waterbath set at 35°C and evaporate to a final volume of 1 mL under a gentle stream of nitrogen.

11) Stopper the graduated test tube and mix the contents by placing on a vortex mixer for about 15 seconds. Submit sample for gas chromatographic analysis.

EQUIPMENT CONDITIONS:

Varian 3700 GC with FPD "P" mode
Column: DB-210 (50% tri-fluoropropyl methyl polysiloxane) 15 m x 0.53 mm x 1.0 um
Carrier gas: Helium, Flow rate: 16 mL/min.
Injector: 220°C.
Detector: 250°C.
Temperature Program: Initial Temp: 150°C held 1 minute
Rate: 20°/ minute
Final Temp: 220° held for 2 minutes
Injection volume: 2 uL
Retention times: Diazinon 0.91 ± 0.05 min.
Diazinon OA 1.59 ± 0.05 min.
Chlorpyrifos 1.73 ± 0.05 min.
Chlorpyrifos OA 2.67 ± 0.05 min.
Ethyl Parathion 2.81 ± 0.05 min.
Ethyl Paraoxon 3.20 ± 0.05 min.

SHIMADZU: GC-14 with FPD "P" mode
Column: HP-17 (50% phenol methyl silicone) 15 m x 0.53 mm x 1.0 um
Carrier gas: Helium, flow rate: 15 mL/min.
Injection: 230°C.
Detector: 260°C.
Temperature program: Initial Temp: 150°C held for 1 minutes.
Rate: 10°C / minute.
Final Temp: 250°C held for 4 minutes.
Injection volume: 2 uL
Retention times: Diazinon 3.61 ± 0.05 min.
Diazinon OA 3.69 ± 0.05min.
Ethyl Paraoxon 5.38 ± 0.05 min.
Chlorpyrifos 5.53 ± 0.05 min.
Ethyl Parathion 5.77 ± 0.05 min.
Chlorpryrifos 5.80 ± 0.05 min.

CALCULATIONS:

Micrograms (UG) Diazinon, Chlorpyrifos, Ethyl Parathion and their Oxygen Analogs

$$\text{ug in sample} = \frac{(\text{peak height sample})(\text{ng/uL std})(\text{uL injected std})(\text{final volume mLs})}{(\text{peak height std})(\text{uL sample injected})}$$

RECOVERIES:

% Recoveries of Diazinon, Chlorpyrifos, Ethyl Parathion and Their Oxygen Analogs

Levels	0.5 ug (Mean)	(SD)	1.0 ug (Mean)	(SD)	5.0 ug (Mean)	(SD)
Diazinon n=3	95	1.15	88	6.24	91	7.51
Diazinon OA n=3	102	4.00	100	6.24	96	4.51
Chloropryifos n=3	99	4.61	96	1.13	100	5.51
Chloropryifos OA n=3	106	3.46	96	3.21	102	3.78
E. Parathion n=3	103	4.61	98	9.64	98	8.18
E. Paraoxon n=3	110	9.24	110	6.66	104	4.51

MINIMUM DETECTABLE LEVEL:

The minimum detectable level was 0.1 ug for the parents and 0.2 ug for Diazinon OA and Ethyl Paraoxon. Chlorpyrifos OA was 0.3 ug (125 mL resin in high volume air sampler) Due to a constantly quite base line S/N=3 was obtained.

REFERENCE:

1.) White, Jane, *Malation and Malaoxon In High Volume Air Sampler Resin* , 1990 Envirnomental Monitoring Methods, California Department of Food and Agriculture.

2.) Echelberry, Jim., *Organophoshate Pesticides In High Volume Air Samples*, 1989 Environmental Monitoring Methods, California Department of Food and Agriculture.

3.) Schlocker, Peter L., *Wilder Ranch - Miscellaneous Organophosphate Pesticides in Low Volume Air Sampler Resin Samples*, 1983 Environmental Monitoring Methods, California Department of Food and Agriculture.

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Original Date: 06/09/89
Supercedes: New
Current Date:08/16/91
Method #:

DIAZINON, CHLORPYRIFOS, ETHYL PARATHION AND THEIR OXYGEN ANALOGS ON MASS DEPOSITION SAMPLES

SCOPE:

This method is for the determination of Diazinon, Chlorpyrifos, Ethyl Parathion and their oxygen analogs on Kimbies®.

PRINCIPLE:

Residues of Diazinon, Chlorpyrifos, Ethyl Parathion and their oxygen analogs were extracted from Kimbies® absorbant towels (with a plastic backing) by shaking them with ethyl acetate. The extract was then concentrated and analyzed by gas chromatography using a flame photometric detector (FPD).

REAGENTS AND EQUIPMENT:

Ethyl acetate (pesticide residue grade)
Wide-mouth gallon jars / lids lined with tin foil
Mechanical shaker (G10 Gyrotory Shaker)
Rotary evaporator (Buchi/Brinkmann, R110)
Nitrogen evaporator (Organomation Model # 12)
Vibrating mixer for test tubes
Kimbie® (Kimberly-Clark Corp.)

ANALYSIS:

1) Place the folded Kimbie® in a quart mason jar. Add 500 mL of ethyl acetate and shake on a mechanical shaker for 30 min. at a setting of ~ 170 RPM.

2) Take 100 mL of extract and concentrate down just to dryness on a rotary evaporator with water bath set at 65°C. Rinse sides of flask with a few milliliters of ethyl acetate.

3) Transfer extract to a graduated test tube. Rinse flask 3 times each with 2 mL of ethyl acetate. Transfer each wash to the same graduated test tube.

4) Place extract on a nitrogen evaporator with water bath set at 35°C and evaporate to a final volume of 1 mL under a gentle stream of nitrogen.

5) Stopper the graduated test tube and mix contents by placing on a vibrating mixer for about 15 seconds. Submit sample for gas

chromatogaphic analysis.

EQUIPMENT CONDITIONS:

SHIMADZU: GC-14 A WITH FPD "P" mode
Column: HP-17 (50% phenyl methyl silicone) 10 m x 0.53 mm x 2.0 um
Carrier gas: Helium, flow rate: 15 mL/min.
Injector: 230°C
Detector: 260°C
Temperature Program: Initial Temp: 150°C held 1 minute
Rate: 10°C/minute
Final Temp: 250° held for 4 minutes
Injection volume: 2 uL
Retention times: Diazinon 3.61 ± 0.05 min.
Diazinon OA 3.69 ± 0.05 min.
Ethyl Paraoxon 5.38 ± 0.05 min.
Chlorpyrifos 5.53 ± 0.05 min.
Ethyl Parathion 5.77 ± 0.05 min.
Chlorpyrifos OA 5.80 ± 0.05 min.

VARIAN 3700 GC WITH FPD "P" mode
Column: DB-210 (50% tri-fluoropropyl methyl polysiloxane) 15 m x 0.537 mm x 1.0 um
Carrier gas: Helium, flow rate: 16 mL/min.
Injector: 220°C
Detector: 250°C
Temperature Program: Initial Temp: 150°C held 1 minute
Rate: 20°C/minute
Final Temp: 220°C held for 2 minutes
Injection volume: 2 uL
Retention times: Diazinon 0.91 ± 0.05 min.
Diazinon OA 1.59 ± 0.05 min.
Chlorpyrifos 1.73 ± 0.05 min.
Chlorpyrifos OA 2.67 ± 0.05 min.
Ethyl Parathion 2.81 ± 0.05 min.
Ethyl Paraoxon 3.20 ± 0.05 min.

CALCULATIONS:

Micrograms (UG) OPs

$$\text{ug in sample} = \frac{(\text{peak height sample})(\text{ng/uL std})(\text{uL injected std})(500\ \text{mL})(\text{final volume mL})}{(\text{peak height std})(\text{uL injected sample})(100\ \text{mL})}$$

RECOVERIES:

% Recoveries of Diazinon, Chlorpyrifos, Ethyl Parathion and Their Oxygen Analogs

Levels	0.5 ug (Mean)	(SD)	1.0 ug (Mean)	(SD)	5.0 ug (Mean)	(SD)
Diazinon (n=3)	89	7.57	98	6.08	99	3.05
Diazinon OA (n=3)	99	1.15	96	4.58	96	1.73
Chlorpyrifos (n=3)	107	2.31	107	3.06	108	2.00
Chlorpyrifos OA (n=3)	100	0	102	7.21	100	5.50
E. Parathion (n=3)	92	5.51	96	5.13	96	1.52
E. Paraoxon (n=3)	90	3.79	97	5.77	99	7.51

Recovery validation was done prior to the samples.

MINIMUM DETECTABLE LEVEL:

The minimum detectable level was 0.3 ug for all compounds except Chlorpyrifos OA which is 0.5 ug. (1 Kimbie® per sample) Due to a constantly quite baseline a S/N=3 was obtained.

DISCUSSION:

The OPs and their oxygen analogs were spiked onto separate Kimbie® sheets at the levels listed above. The Kimbies® were allowed to dry before extracting them.

REFERENCE:

1) White, Jane., *Malathion and Malaoxon on Mass Deposition Samples*, 1990, Environmental Monitoring Methods, California Department of Food and Agriculture.

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APPENDIX 3

Analytical Method Validation
and
Quality Control Results

Table 1. Method validation data (% recoveries) for the Summer OP Residue Study.

Study: 110
Analyte: Diazinon
MDL: 0.01 ppm
Date of Report: 8/6/91

Sample Type: Pepper
Lab: CDFA
Chemist: Jane White

Lab Sample #	Results (ppm)	Spike Level (ppm)	Recovery %	$\bar{X}$	SD	CV (%)
74	0.031	0.03	103			
78	0.029	0.03	97	100	4.24	4.24
75	0.055	0.05	110			
79	0.047	0.05	94	102	11.3	11.1
76	0.23	0.20	115			
80	0.23	0.20	115	115	0	0
77	1.04	1.00	104			
81	1.01	1.00	101	103	2.12	2.07
			OVERALL:	105	7.85	7.48

$\bar{X}$	SD	LWL	UWL	LCL	UCL
105	7.85	97	113	89	121

Table 2. Method validation data (% recoveries) for the Summer OP Residue Study.

Study: 110
Analyte: Diazoxon
MDL: 0.01 ppm
Date of Report: 8/6/91

Sample Type: Pepper
Lab: CDFA
Chemist: Jane White

Lab Sample #	Results (ppm)	Spike Level (ppm)	Recovery %	$\bar{X}$	SD	CV (%)
74	0.034	0.03	113			
78	0.032	0.03	106	110	4.95	4.52
75	0.046	0.05	92			
79	0.043	0.05	86	89	4.2	4.8
76	0.23	0.20	115			
80	0.24	0.20	120	118	4	3
77	1.04	1.00	104			
81	1.03	1.00	103	104	0.71	0.68
			OVERALL:	105	11.49	10.96

$\bar{X}$	SD	LWL	UWL	LCL	UCL
105	11.5	94	117	82	128

LWL/UWL (lower warning limit/ upper warning limit) = mean +/- SD
LCL/UCL (lower control limit/ upper control limit) = mean +/- 2 SD

Table 3. Method validation data (% recoveries) for the Summer OP Residue Study.

Study: 110
Analyte: Dursban
MDL: 0.01 ppm
Date of Report: 8/6/91

Sample Type: Pepper
Lab: CDFA
Chemist: Jane White

Lab Sample #	Results (ppm)	Spike Level (ppm)	Recovery %	$\bar{X}$	SD	CV (%)
74	0.032	0.03	106			
78	0.026	0.03	87	97	13	14
75	0.053	0.05	106			
79	0.045	0.05	90	98	11	12
76	0.23	0.20	115			
80	0.24	0.20	120	118	3.54	3.01
77	1.08	1.00	108			
81	1.08	1.00	108	108	0.00	0.00
			OVERALL:	105	11.3	10.8

$\bar{X}$	SD	LWL	UWL	LCL	UCL
105	11.3	94	116	82	128

LWL/UWL (lower warning limit/ upper warning limit) = mean +/- SD
LCL/UCL (lower control limit/ upper control limit) = mean +/- 2 SD

Table 4. Method validation data (% recoveries) for the Summer OP Residue Study.

Study: 110
Analyte: Ethyl parathion
MDL: 0.01 ppm
Date of Report: 8/6/91

Sample Type: Pepper
Lab: CDFA
Chemist: Jane White

Lab Sample #	Results (ppm)	Spike Level (ppm)	Recovery %	$\bar{X}$	SD	CV (%)
74	0.032	0.03	106			
78	0.029	0.03	97	102	6.36	6.27
75	0.055	0.05	110			
79	0.045	0.05	90	100	14.1	14.1
76	0.22	0.20	110			
80	0.24	0.20	120	115	7.07	6.15
77	1.09	1.00	109			
81	1.10	1.00	110	110	0.71	0.65
			OVERALL:	107	9.17	8.61

$\bar{X}$	SD	LWL	UWL	LCL	UCL
107	9.17	98	116	89	125

Table 5. Method validation data (% recoveries) for the Summer OP Residue Study.

Study: 110
Analyte: Ethyl paraoxon
MDL: 0.01 ppm
Date of Report: 8/6/91

Sample Type: Pepper
Lab: CDFA
Chemist: Jane White

Lab Sample #	Results (ppm)	Spike Level (ppm)	Recovery %	$\bar{X}$	SD	CV (%)
74	0.032	0.03	106			
78	0.031	0.03	103	105	2.12	2.03
75	0.044	0.05	88			
79	0.043	0.05	86	87	1.4	1.6
76	0.24	0.20	120			
80	0.25	0.20	125	123	3.54	2.89
77	0.95	1.00	95			
81	1.01	1.00	101	98	4.2	4.3
			OVERALL:	103	14.0	13.6

$\bar{X}$	SD	LWL	UWL	LCL	UCL
103	14	89	117	75	131

LWL/UWL (lower warning limit/ upper warning limit) = mean +/- SD
LCL/UCL (lower control limit/ upper control limit) = mean +/- 2 SD

Table 6. Method validation data (% recoveries) for the Summer OP Residue Study.

Study: 110
Analyte: Diazinon
MDL: 0.01 ppm
Date of Report: 8/6/91

Sample Type: Parsley
Lab: CDFA
Chemist: Jane White

Lab Sample #	Results (ppm)	Spike Level (ppm)	Recovery %	$\bar{X}$	SD	CV (%)
331	0.031	0.03	103			
335	0.032	0.03	106	105	2.12	2.03
332	0.047	0.05	94			
336	0.051	0.05	102	98	5.7	5.8
333	0.22	0.20	110			
337	0.21	0.20	105	108	3.54	3.29
334	0.93	1.00	93			
338	0.94	1.00	94	94	0.71	0.76
			OVERALL:	101	6.42	6.37

$\bar{X}$	SD	LWL	UWL	LCL	UCL
101	6.42	95	107	88	114

Table 7. Method validation data (% recoveries) for the Summer OP Residue Study.

Study: 110
Analyte: Diazoxon
MDL: 0.01 ppm
Date of Report: 8/6/91

Sample Type: Parsley
Lab: CDFA
Chemist: Jane White

Lab Sample #	Results (ppm)	Spike Level (ppm)	Recovery %	$\bar{X}$	SD	CV (%)
331	0.030	0.03	100			
335	0.030	0.03	100	100	0.00	0.00
332	0.045	0.05	90			
336	0.050	0.05	100	95	7.1	7.4
333	0.23	0.20	115			
337	0.20	0.20	100	108	10.6	9.9
334	0.95	1.00	95			
338	0.94	1.00	94	95	0.71	0.75
			OVERALL:	99	7.4	7.4

$\bar{X}$	SD	LWL	UWL	LCL	UCL
99	7.4	92	106	84	114

LWL/UWL (lower warning limit/ upper warning limit) = mean +/- SD
LCL/UCL (lower control limit/ upper control limit) = mean +/- 2 SD

Table 8. Method validation data (% recoveries) for the Summer OP Residue Study.

Study: 110
Analyte: Dursban
MDL: 0.01 ppm
Date of Report: 8/6/91

Sample Type: Parsley
Lab: CDFA
Chemist: Jane White

Lab Sample #	Results (ppm)	Spike Level (ppm)	Recovery %	$\bar{X}$	SD	CV (%)
331	0.031	0.03	103			
335	0.031	0.03	103	103	0	0
332	0.048	0.05	96			
336	0.049	0.05	98	97	1.4	1.5
333	0.20	0.20	100			
337	0.20	0.20	100	100	0.00	0.00
334	0.88	1.00	88			
338	0.90	1.00	90	89	1.4	1.6
			OVERALL:	97	5.6	5.8

$\bar{X}$	SD	LWL	UWL	LCL	UCL
97	5.6	91	103	86	108

LWL/UWL (lower warning limit/ upper warning limit) = mean +/- SD
LCL/UCL (lower control limit/ upper control limit) = mean +/- 2 SD

Table 9. Method validation data (% recoveries) for the Summer OP Residue Study.

Study: 110
Analyte: Ethyl parathion
MDL: 0.01 ppm
Date of Report: 8/6/91

Sample Type: Parsley
Lab: CDFA
Chemist: Jane White

Lab Sample #	Results (ppm)	Spike Level (ppm)	Recovery %	$\bar{X}$	SD	CV (%)
331	0.030	0.03	100			
335	0.032	0.03	106	103	4.24	4.12
332	0.050	0.05	100			
336	0.049	0.05	98	99	1.4	1.4
333	0.21	0.20	105			
337	0.20	0.20	100	103	3.54	3.45
334	0.94	1.00	94			
338	0.94	1.00	94	94	0.00	0.00
			OVERALL:	100	4.41	4.42

$\bar{X}$	SD	LWL	UWL	LCL	UCL
100	4.41	96	104	91	109

Table 10. Method validation data (% recoveries) for the Summer OP Residue Study.

Study: 110
Analyte: Ethyl paraoxon
MDL: 0.01 ppm
Date of Report: 8/6/91

Sample Type: Parsley
Lab: CDFA
Chemist: Jane White

Lab Sample #	Results (ppm)	Spike Level (ppm)	Recovery %	$\bar{X}$	SD	CV (%)
331	0.030	0.03	100			
335	0.030	0.03	100	100	0	0
332	0.047	0.05	94			
336	0.047	0.05	94	94	0	0
333	0.22	0.20	110			
337	0.22	0.20	110	110	0	0
334	1.01	1.00	101			
338	1.01	1.00	101	101	0	0
			OVERALL:	101	6.11	6.04

$\bar{X}$	SD	LWL	UWL	LCL	UCL
101	6.11	95	107	89	113

LWL/UWL (lower warning limit/ upper warning limit) = mean +/- SD
LCL/UCL (lower control limit/ upper control limit) = mean +/- 2 SD

Table 11. Method validation data (% recoveries) for the Summer OP Residue Study.

Study: 110
Analyte: Diazinon
MDL: 0.1 ug/sample
Date of Report: 8/6/91

Sample Type: XAD-2 resin
Lab: CDFA
Chemist: Jane White

Lab Sample #	Results (ug/sample)	Spike Level (ug/sample)	Recovery %	$\bar{X}$	SD	CV (%)
461	0.47	0.50	94			
464	0.48	0.50	96			
467	0.48	0.50	96	95	1.2	1.2
462	0.86	1.0	86			
465	0.83	1.0	83			
468	0.95	1.0	95	88	6.2	7.1
463	4.56	5.0	91			
466	4.15	5.0	83			
469	4.90	5.0	98	91	7.5	8.3
			OVERALL:	91	5.9	6.4

$\bar{X}$	SD	LWL	UWL	LCL	UCL
91	5.9	85	97	79	103

Table 12. Method validation data (% recoveries) for the Summer OP Residue Study.

Study: 110
Analyte: Diazoxon
MDL: 0.2 ug/sample
Date of Report: 8/6/91

Sample Type: XAD-2 resin
Lab: CDFA
Chemist: Jane White

Lab Sample #	Results (ug/sample)	Spike Level (ug/sample)	Recovery %	$\bar{X}$	SD	CV (%)
461	0.53	0.50	106			
464	0.51	0.50	102			
467	0.49	0.50	98	102	4.00	3.92
462	1.02	1.0	102			
465	0.93	1.0	93			
468	1.05	1.0	105	100	6.24	6.24
463	4.81	5.0	96			
466	4.60	5.0	92			
469	5.05	5.0	101	96	4.5	4.7
			OVERALL:	99	5.0	5.0

$\bar{X}$	SD	LWL	UWL	LCL	UCL
99	5	94	104	89	109

LWL/UWL (lower warning limit/ upper warning limit) = mean +/- SD
LCL/UCL (lower control limit/ upper control limit) = mean +/- 2 SD

Table 13. Method validation data (% recoveries) for the Summer OP Residue Study.

Study: 110
Analyte: Dursban
MDL: 0.1 ug/sample
Date of Report: 8/6/91

Sample Type: XAD-2 resin
Lab: CDFA
Chemist: Jane White

Lab Sample #	Results (ug/sample)	Spike Level (ug/sample)	Recovery %	$\bar{X}$	SD	CV (%)
461	0.47	0.50	94			
464	0.51	0.50	102			
467	0.51	0.50	102	99	4.6	4.6
462	0.95	1.0	95			
465	0.97	1.0	97			
468	0.97	1.0	97	96	1.2	1.2
463	5.00	5.0	100			
466	4.68	5.0	94			
469	5.25	5.0	105	100	5.51	5.53
			OVERALL:	98	4.0	4.0

$\bar{X}$	SD	LWL	UWL	LCL	UCL
98	4	94	102	90	106

Table 14. Method validation data (% recoveries) for the Summer OP Residue Study.

Study: 110
Analyte: Dursban OA
MDL: 0.3 ug/sample
Date of Report: 8/6/91

Sample Type: XAD-2 resin
Lab: CDFA
Chemist: Jane White

Lab Sample #	Results (ug/sample)	Spike Level (ug/sample)	Recovery %	$\bar{X}$	SD	CV (%)
461	0.55	0.50	110			
464	0.52	0.50	104			
467	0.52	0.50	104	106	3.46	3.27
462	1.00	1.0	100			
465	0.94	1.0	94			
468	0.95	1.0	95	96	3.2	3.3
463	5.20	5.0	104			
466	5.25	5.0	105			
469	4.88	5.0	98	102	3.79	3.70
			OVERALL:	102	5.20	5.12

$\bar{X}$	SD	LWL	UWL	LCL	UCL
102	5.2	97	107	92	112

LWL/UWL (lower warning limit/ upper warning limit) = mean +/- SD
LCL/UCL (lower control limit/ upper control limit) = mean +/- 2 SD

Table 15. Method validation data (% recoveries) for the Summer OP Residue Study.

Study: 110
Analyte: Ethyl parathion
MDL: 0.1 ug/sample
Date of Report: 8/6/91

Sample Type: XAD-2 resin
Lab: CDFA
Chemist: Jane White

Lab Sample #	Results (ug/sample)	Spike Level (ug/sample)	Recovery %	$\bar{X}$	SD	CV (%)
461	0.50	0.50	100			
464	0.50	0.50	100			
467	0.54	0.50	108	103	4.62	4.50
462	1.02	1.0	102			
465	0.87	1.0	87			
468	1.05	1.0	105	98	9.6	9.8
463	4.79	5.0	96			
466	4.54	5.0	91			
469	5.36	5.0	107	98	8.2	8.4
			OVERALL:	100	7.13	7.16

$\bar{X}$	SD	LWL	UWL	LCL	UCL
100	7.13	100	107	86	114

Table 16. Method validation data (% recoveries) for the Summer OP Residue Study.

Study: 110
Analyte: Ethyl paraoxon
MDL: 0.2 ug/sample
Date of Report: 8/6/91

Sample Type: XAD-2 resin
Lab: CDFA
Chemist: Jane White

Lab Sample #	Results (ug/sample)	Spike Level (ug/sample)	Recovery %	$\bar{X}$	SD	CV (%)
461	0.50	0.50	100			
464	0.58	0.50	116			
467	0.58	0.50	116	111	9.24	8.35
462	1.14	1.0	114			
465	1.03	1.0	103			
468	1.15	1.0	115	111	6.66	6.02
463	4.93	5.0	99			
466	5.38	5.0	108			
469	5.29	5.0	104	104	4.51	4.35
			OVERALL:	108	7.05	6.51

$\bar{X}$	SD	LWL	UWL	LCL	UCL
108	7.05	101	115	94	122

LWL/UWL (lower warning limit/ upper warning limit) = mean +/- SD
LCL/UCL (lower control limit/ upper control limit) = mean +/- 2 SD

Table 17. Method validation data (% recoveries) for the Summer OP Residue Study.

Study: 110
Analyte: Diazinon
MDL: 0.3 ug/sample
Date of Report: 8/6/91

Sample Type: Kimbie
Lab: CDFA
Chemist: Jane White

Lab Sample #	Results (ug/sample)	Spike Level (ug/sample)	Recovery %	$\bar{X}$	SD	CV (%)
443	0.40	0.50	80			
446	0.47	0.50	94			
449	0.46	0.50	92	89	7.6	8.5
444	0.95	1.0	95			
447	0.94	1.0	94			
450	1.05	1.0	105	98	6.1	6.2
445	4.81	5.0	96			
448	4.90	5.0	98			
451	5.10	5.0	102	99	3.1	3.1
			OVERALL:	95	7.0	7.4

$\bar{X}$	SD	LWL	UWL	LCL	UCL
95	7	88	102	81	109

Table 18. Method validation data (% recoveries) for the Summer OP Residue Study.

Study: 110
Analyte: Diazoxon
MDL: 0.3 ug/sample
Date of Report: 8/6/91

Sample Type: Kimbie
Lab: CDFA
Chemist: Jane White

Lab Sample #	Results (ug/sample)	Spike Level (ug/sample)	Recovery %	$\bar{X}$	SD	CV (%)
461	0.50	0.50	100			
464	0.49	0.50	98			
467	0.50	0.50	100	99	1.2	1.2
462	1.00	1.0	100			
465	0.91	1.0	91			
468	0.97	1.0	97	96	4.6	4.8
463	4.88	5.0	98			
466	4.76	5.0	95			
469	4.75	5.0	95	96	1.7	1.8
			OVERALL:	97	3.0	3.1

$\bar{X}$	SD	LWL	UWL	LCL	UCL
97	3	94	100	91	103

LWL/UWL (lower warning limit/ upper warning limit) = mean +/- SD
LCL/UCL (lower control limit/ upper control limit) = mean +/- 2 SD

Table 19. Method validation data (% recoveries) for the Summer OP Residue Study.

Study: 110
Analyte: Dursban
MDL: 0.3 ug/sample
Date of Report: 8/6/91

Sample Type: Kimble
Lab: CDFA
Chemist: Jane White

Lab Sample #	Results (ug/sample)	Spike Level (ug/sample)	Recovery %	$\bar{X}$	SD	CV (%)
443	0.53	0.50	106			
446	0.53	0.50	106			
449	0.55	0.50	110	107	2.31	2.15
444	1.11	1.0	111			
447	1.07	1.0	107			
450	1.05	1.0	105	108	3.06	2.84
445	5.38	5.0	108			
448	5.52	5.0	110			
451	5.30	5.0	106	108	2.00	1.85
			OVERALL:	108	2.18	2.02

$\bar{X}$	SD	LWL	UWL	LCL	UCL
108	2.18	106	110	104	112

Table 20. Method validation data (% recoveries) for the Summer OP Residue Study.

Study: 110
Analyte: Dursban OA
MDL: 0.5 ug/sample
Date of Report: 8/6/91

Sample Type: Kimbie
Lab: CDFA
Chemist: Jane White

Lab Sample #	Results (ug/sample)	Spike Level (ug/sample)	Recovery %	$\bar{X}$	SD	CV (%)
461	0.50	0.50	100			
464	0.50	0.50	100			
467	0.50	0.50	100	100	0.00	0.00
462	1.11	1.0	111			
465	1.11	1.0	111			
468	0.96	1.0	96	106	8.66	8.17
463	5.28	5.0	106			
466	5.00	5.0	100			
469	4.75	5.0	95	100	5.51	5.49
			OVERALL:	102	5.90	5.78

$\bar{X}$	SD	LWL	UWL	LCL	UCL
102	5.9	96	108	90	114

LWL/UWL (lower warning limit/ upper warning limit) = mean +/- SD
LCL/UCL (lower control limit/ upper control limit) = mean +/- 2 SD

Table 21. Method validation data (% recoveries) for the Summer OP Residue Study.

Study: 110
Analyte: Ethyl parathion
MDL: 0.3 ug/sample
Date of Report: 8/6/91

Sample Type: Kimbie
Lab: CDFA
Chemist: Jane White

Lab Sample #	Results (ug/sample)	Spike Level (ug/sample)	Recovery %	$\bar{X}$	SD	CV (%)
443	0.48	0.50	96			
446	0.43	0.50	86			
449	0.47	0.50	95	92	5.5	6.0
444	1.02	1.0	102			
447	0.92	1.0	92			
450	0.95	1.0	95	96	5.1	5.3
445	4.90	5.0	98			
448	4.79	5.0	96			
451	4.75	5.0	95	96	1.5	1.6
			OVERALL:	95	4.3	4.6

$\bar{X}$	SD	LWL	UWL	LCL	UCL
95	4.3	91	99	86	104

Table 22. Method validation data (% recoveries) for the Summer OP Residue Study.

Study: 110
Analyte: Ethyl paraoxon
MDL: 0.3 ug/sample
Date of Report: 8/6/91

Sample Type: Kimbie
Lab: CDFA
Chemist: Jane White

Lab Sample #	Results (ug/sample)	Spike Level (ug/sample)	Recovery %	$\bar{X}$	SD	CV (%)
461	0.47	0.50	94			
464	0.44	0.50	88			
467	0.43	0.50	87	90	3.8	4.2
462	1.00	1.0	100			
465	0.90	1.0	90			
468	1.00	1.0	100	97	5.8	6.0
463	5.15	5.0	103			
466	5.14	5.0	103			
469	4.50	5.0	90	99	7.5	7.6
			OVERALL:	95	6.5	6.9

$\bar{X}$	SD	LWL	UWL	LCL	UCL
95	6.5	89	102	82	108

LWL/UWL (lower warning limit/ upper warning limit) = mean +/- SD
LCL/UCL (lower control limit/ upper control limit) = mean +/- 2 SD

Table 23. Continuing quality control data for the Summer OP Residue Study.

Study: 110
Analyte: Diazinon
MDL: 0.01 ppm
Date of Report: 10/15/91

Sample Type: Pepper
Lab: CDFA
Chemist: Jane White

Extraction Set no.'s	Lab Sample #	Results (ppm)	Spike Level (ppm)	Recovery %	$\bar{X}$	SD	CV (%)
1, 4, 5, 8, 25, 27, 29, 31, 33, 56, 59, 74, 75, 1001	832	0.047	0.05	94			
9, 12, 14, 17, 18, 21, 35, 38, 40, 42, 44, 47, 78, 79,, 82	857	0.043	0.05	86			
				OVERALL:	90	5.7	6.3

Table 24. Continuing quality control data for the Summer OP Residue Study.

Study: 110
Analyte: Diazoxon
MDL: 0.02 ppm
Date of Report: 10/15/91

Sample Type: Pepper
Lab: CDFA
Chemist: Jane White

Extraction Set no.'s	Lab Sample #	Results (ppm)	Spike Level (ppm)	Recovery %	$\bar{X}$	SD	CV (%)
1, 4, 5, 8, 25, 27, 29, 31, 33, 56, 59, 74, 75, 1001	832	0.043	0.05	86			
9, 12, 14, 17, 18, 21, 35, 38, 40, 42, 44, 47, 78, 79,, 82	857	0.048	0.05	96			
				OVERALL:	91	7.1	7.8

Table 25. Continuing quality control data for the Summer OP Residue Study.

Study: 110
Analyte: Ethyl Parathion
MDL: 0.01 ppm
Date of Report: 10/15/91

Sample Type: Pepper
Lab: CDFA
Chemist: Jane White

Extraction Set no.'s	Lab Sample #	Results (ppm)	Spike Level (ppm)	Recovery %	$\bar{X}$	SD	CV (%)
1, 4, 5, 8, 25, 27, 29, 31, 33, 56, 59, 74, 75, 1001	832	0.047	0.05	94			
9, 12, 14, 17, 18, 21, 35, 38, 40, 42, 44, 47, 78, 79,, 82	857	0.046	0.05	92			
				OVERALL:	93	1.4	1.5

Table 26. Continuing quality control data for the Summer OP Residue Study.

Study: 110
Analyte: Ethyl Paraoxon
MDL: 0.02 ppm
Date of Report: 10/15/91

Sample Type: Pepper
Lab: CDFA
Chemist: Jane White

Extraction Set no.'s	Lab Sample #	Results (ppm)	Spike Level (ppm)	Recovery %	$\bar{X}$	SD	CV (%)
1, 4, 5, 8, 25, 27, 29, 31, 33, 56, 59, 74, 75, 1001	832	0.052	0.05	104			
9, 12, 14, 17, 18, 21, 35, 38, 40, 42, 44, 47, 78, 79,, 82	857	0.053	0.05	106			
				OVERALL:	105	1.4	1.3

Table 27. Continuing quality control data for the Summer OP Residue Study.

Study: 110
Analyte: Chlorpyrifos
MDL: 0.01 ppm
Date of Report: 10/15/91

Sample Type: Pepper
Lab: CDFA
Chemist: Jane White

Extraction Set no.'s	Lab Sample #	Results (ppm)	Spike Level (ppm)	Recovery %	$\bar{X}$	SD	CV (%)
1, 4, 5, 8, 25, 27, 29, 31, 33, 56, 59, 74, 75, 1001	832	0.049	0.05	98			
9, 12, 14, 17, 18, 21, 35, 38, 40, 42, 44, 47, 78, 79,, 82	857	0.047	0.05	94			
				OVERALL:	96	2.8	2.9

Table 28. Continuing quality control data for the Summer OP Residue Study.

Study: 110
Analyte: Chlorpyrifos OA
MDL: 0.03 ppm
Date of Report: 10/15/91

Sample Type: Pepper
Lab: CDFA
Chemist: Jane White

Extraction Set no.'s	Lab Sample #	Results (ppm)	Spike Level (ppm)	Recovery %	$\bar{X}$	SD	CV (%)
1, 4, 5, 8, 25, 27, 29, 31, 33, 56, 59, 74, 75, 1001	832	0.056	0.05	112			
9, 12, 14, 17, 18, 21, 35, 38, 40, 42, 44, 47, 78, 79,, 82	857	0.059	0.05	118			
				OVERALL:	115	4.2	3.7

Table 29. Continuing quality control data for the Summer OP Residue Study.

Study: 110 — Sample Type: Parsley
Analyte: Diazinon — Lab: CDFA
MDL: 0.01 ppm — Chemist: Jane White
Date of Report: 10/15/91

Extraction Set no.'s	Lab Sample #	Results (ppm)	Spike Level (ppm)	Recovery %	$\bar{X}$	SD	CV (%)
70, 71, 72, 73	558	0.051	0.05	102			
49-55, 61-67	647	0.046	0.05	92			
2, 3, 6, 7, 26, 28, 30, 32, 34, 57 68, 69, 76, 1000	848	0.045	0.05	90			
				OVERALL:	95	6.4	6.8

Table 30. Continuing quality control data for the Summer OP Residue Study.

Study: 110 — Sample Type: Parsley
Analyte: Diazoxon — Lab: CDFA
MDL: 0.01 ppm — Chemist: Jane White
Date of Report: 10/15/91

Extraction Set no.'s	Lab Sample #	Results (ppm)	Spike Level (ppm)	Recovery %	$\bar{X}$	SD	CV (%)
70, 71, 72, 73	558	0.051	0.05	102			
49-55, 61-67	647	0.051	0.05	102			
2, 3, 6, 7, 26, 28, 30, 32, 34, 57 68, 69, 76, 1000	848	0.043	0.05	86			
				OVERALL:	97	9.2	9.6

Table 31. Continuing quality control data for the Summer OP Residue Study.

Study: 110 — Sample Type: Parsley
Analyte: Ethyl Parathion — Lab: CDFA
MDL: 0.01 ppm — Chemist: Jane White
Date of Report: 10/15/91

Extraction Set no.'s	Lab Sample #	Results (ppm)	Spike Level (ppm)	Recovery %	$\bar{X}$	SD	CV (%)
70, 71, 72, 73	558	0.052	0.05	104			
49-55, 61-67	647	0.044	0.05	88			
2, 3, 6, 7, 26, 28, 30, 32, 34, 57 68, 69, 76, 1000	848	0.046	0.05	92			
				OVERALL:	95	8.3	8.8

Table 32. Continuing quality control data for the Summer OP Residue Study.

Study: 110 — Sample Type: Parsley
Analyte: Ethyl Paraoxon — Lab: CDFA
MDL: 0.01 ppm — Chemist: Jane White
Date of Report: 10/15/91

Extraction Set no.'s	Lab Sample #	Results (ppm)	Spike Level (ppm)	Recovery %	$\bar{X}$	SD	CV (%)
70, 71, 72, 73	558	0.047	0.05	94			
49-55, 61-67	647	0.050	0.05	100			
2, 3, 6, 7, 26, 28, 30, 32, 34, 57 68, 69, 76, 1000	848	0.047		94			
				OVERALL:	96	3.5	3.6

Table 33. Continuing quality control data for the Summer OP Residue Study.

Study: 110
Analyte: Chlorpyrifos
MDL: 0.01 ppm
Date of Report: 10/15/91

Sample Type: Parsley
Lab: CDFA
Chemist: Jane White

Extraction Set no.'s	Lab Sample #	Results (ppm)	Spike Level (ppm)	Recovery %	$\bar{X}$	SD	CV (%)
70, 71, 72, 73	558	0.050	0.05	100			
49-55, 61-67	647	0.047	0.05	94			
2, 3, 6, 7, 26, 28, 30, 32, 34, 57 68, 69, 76, 1000	848	0.048	0.05	96			
				OVERALL:	97	3.1	3.2

Table 34. Continuing quality control data for the Summer OP Residue Study.

Study: 110
Analyte: Chlorpyrifos OA
MDL: 0.01 ppm
Date of Report: 10/15/91

Sample Type: Parsley
Lab: CDFA
Chemist: Jane White

Extraction Set no.'s	Lab Sample #	Results (ppm)	Spike Level (ppm)	Recovery %	$\bar{X}$	SD	CV (%)
70, 71, 72, 73	558	0.050	0.05	100			
49-55, 61-67	647	0.052	0.05	104			
2, 3, 6, 7, 26, 28, 30, 32, 34, 57 68, 69, 76, 1000	848	0.049	0.05	98			
				OVERALL:	101	3.06	3.03

Table 35. Continuing quality control data for the Summer OP Residue Study.

Study: 110 — Sample Type: XAD-2 Resin
Analyte: Diazinon — Lab: CDFA
MDL: 0.1ug/sample — Chemist: Jane White
Date of Report: 10/15/91

Extraction Set no.'s	Lab Sample #	Results (ug/sample)	Spike Level (ug/sample)	Recovery %	$\bar{X}$	SD	CV (%)
	13	0.5	0.45	90			
128, 131, 132, 133	566	0.5	0.45	90			
126, 127, 134, 135	677	0.5	0.45	90			
130, 136, 137, 138	693	0.5	0.45	90			
			OVERALL:		90	0.0	0.0

Table 36. Continuing quality control data for the Summer OP Residue Study.

Study: 110 — Sample Type: XAD-2 resin
Analyte: Diazoxon — Lab: CDFA
MDL: 0.2 ug/sample — Chemist: Jane White
Date of Report: 10/15/91

Extraction Set no.'s	Lab Sample #	Results (ug/sample)	Spike Level (ug/sample)	Recovery %	$\bar{X}$	SD	CV (%)
	12	0.5	0.51	102			
128, 131, 132, 133	566	0.5	0.49	98			
126, 127, 134, 135	677	0.5	0.50	100			
130, 136, 137, 138	693	0.5	0.46	92			
			OVERALL:		98	4.3	4.4

Table 37. Continuing quality control data for the Summer OP Residue Study.

Study: 110 — Sample Type: XAD-2 resin
Analyte: Ethyl Parathion — Lab: CDFA
MDL: 0.1 ug/sample — Chemist: Jane White
Date of Report: 10/15/91

Extraction Set no.'s	Lab Sample #	Results (ug/sample)	Spike Level (ug/sample)	Recovery %	$\bar{X}$	SD	CV (%)
	12	0.5	0.44	88			
128, 131, 132, 133	566	0.5	0.46	92			
126, 127, 134, 135	677	0.5	0.46	92			
130, 136, 137, 138	693	0.5	0.45	90			
			OVERALL:		91	1.9	2.1

Table 38. Continuing quality control data for the Summer OP Residue Study.

Study: 110 — Sample Type: XAD-2 resin
Analyte: Ethyl Paraoxon — Lab: CDFA
MDL: 0.2 ug/sample — Chemist: Jane White
Date of Report: 10/15/91

Extraction Set no.'s	Lab Sample #	Results (ug/sample)	Spike Level (ug/sample)	Recovery %	$\bar{X}$	SD	CV (%)
	12	0.5	0.51	102			
128, 131, 132, 133	566	0.5	0.51	102			
126, 127, 134, 135	677	0.5	0.56	112			
130, 136, 137, 138	693	0.5	0.50	100			
			OVERALL:		104	5.42	5.21

Table 39. Continuing quality control data for the Summer OP Residue Study.

Study: 110
Analyte: Chlorpyrifos
MDL: 0.1 ug/sample
Date of Report: 10/15/91

Sample Type: XAD-2 resin
Lab: CDFA
Chemist: Jane White

Extraction Set no.'s	Lab Sample #	Results (ug/sample)	Spike Level (ug/sample)	Recovery %	$\bar{X}$	SD	CV (%)
	12	0.5	0.41	83			
128, 131, 132, 133	566	0.5	0.43	86			
126, 127, 134, 135	677	0.5	0.45	90			
130, 136, 137, 138	693	0.5	0.46	92			
				OVERALL:	88	4.0	4.6

Table 40. Continuing quality control data for the Summer OP Residue Study.

Study: 110
Analyte: Chlorpyrifos OA
MDL: 0.3 ug/sample
Date of Report: 10/15/91

Sample Type: XAD-2 resin
Lab: CDFA
Chemist: Jane White

Extraction Set no.'s	Lab Sample #	Results (ug/sample)	Spike Level (ug/sample)	Recovery %	$\bar{X}$	SD	CV (%)
	12	0.5	0.46	92			
128, 131, 132, 133	566	0.5	0.47	94			
126, 127, 134, 135	677	0.5	0.54	108			
130, 136, 137, 138	693	0.5	0.51	102			
				OVERALL:	99	7.4	7.5

Table 41. Continuing quality control data for the Summer OP Residue Study.

Study: 110 — Sample Type: Kimbie
Analyte: Diazinon — Lab: CDFA
MDL: 0.3 ug/sample — Chemist: Jane White
Date of Report: 10/15/91

Extraction Set no.'s	Lab Sample #	Results (ug/sample)	Spike Level (ug/sample)	Recovery %	$\bar{X}$	SD	CV (%)
1, 2, 3, ... 8	549	0.5	0.47	94			
20, 21, 22, ...30	547	0.5	0.48	95			
			OVERALL:		95	0.7	0.7

Table 42. Continuing quality control data for the Summer OP Residue Study.

Study: 110 — Sample Type: Kimbie
Analyte: Diazoxon — Lab: CDFA
MDL: 0.3 ug/sample — Chemist: Jane White
Date of Report: 10/15/91

Extraction Set no.'s	Lab Sample #	Results (ug/sample)	Spike Level (ug/sample)	Recovery %	$\bar{X}$	SD	CV (%)
1, 2, 3, ... 8	549	0.5	0.50	100			
20, 21, 22, ...30	547	0.5	0.47	94			
			OVERALL:		97	4.2	4.4

Table 43. Continuing quality control data for the Summer OP Residue Study.

Study: 110 — Sample Type: Kimbie
Analyte: Ethyl Parathion — Lab: CDFA
MDL: 0.3 ug/sample — Chemist: Jane White
Date of Report: 10/15/91

Extraction Set no.'s	Lab Sample #	Results (ug/sample)	Spike Level (ug/sample)	Recovery %	$\bar{X}$	SD	CV (%)
1, 2, 3, ... 8	549	0.5	0.45	91			
20, 21, 22, ...30	547	0.5	0.43	86			
			OVERALL:		89	3.5	4.0

Table 44. Continuing quality control data for the Summer OP Residue Study.

Study: 110 — Sample Type: Kimbie
Analyte: Ethyl Paraoxon — Lab: CDFA
MDL: 0.3 ug/sample — Chemist: Jane White
Date of Report: 10/15/91

Extraction Set no.'s	Lab Sample #	Results (ug/sample)	Spike Level (ug/sample)	Recovery %	$\bar{X}$	SD	CV (%)
1, 2, 3, ... 8	549	0.5	0.44	88			
20, 21, 22, ...30	547	0.5	0.42	83			
			OVERALL:		86	3.5	4.1

Table 45. Continuing quality control data for the Summer OP Residue Study.

Study: 110
Analyte: Chlorpyrifos
MDL: 0.3 ug/sample
Date of Report: 10/15/91

Sample Type: Kimbie
Lab: CDFA
Chemist: Jane White

Extraction Set no.'s	Lab Sample #	Results (ug/sample)	Spike Level (ug/sample)	Recovery %	$\bar{X}$	SD	CV (%)
1, 2, 3, ... 8	549	0.5	0.50	100			
20, 21, 22, ...30	547	0.5	0.50	100			
				OVERALL:	100	0.00	0.00

Table 46. Continuing quality control data for the Summer OP Residue Study.

Study: 110
Analyte: Chlorpyrifos OA
MDL: 0.5 ug/sample
Date of Report: 10/15/91

Sample Type: Kimbie
Lab: CDFA
Chemist: Jane White

Extraction Set no.'s	Lab Sample #	Results (ug/sample)	Spike Level (ug/sample)	Recovery %	$\bar{X}$	SD	CV (%)
1, 2, 3, ... 8	549	0.5	0.47	94			
20, 21, 22, ...30	547	0.5	0.50	100			
				OVERALL:	97	4.2	4.4

APPENDIX 4

Parsley, Bell Pepper, Air, and Mass Depsition Data

OBS	SN1	CC1	LC1	TRS1	DATE1	EXPO1	PTYP1	DIA1	DOA1	PAR1	POA1	CHL1	COA1	WWT1	PMST1
1	0052	27	09	16S04E03	224	11	PAR	ND	ND	ND	ND	0.013	ND	50.0	NA
2	0049	27	03	15S02E03	224	12	PAR	0.023	ND	ND	ND	ND	ND	50.0	NA
3	0050	27	04	14S03E31	224	12	PAR	0.012	ND	ND	ND	ND	ND	50.0	NA
4	0051	27	06	15S03E03	224	12	PAR	ND	ND	ND	ND	ND	ND	50.0	79.0
5	0054	27	10	16S05E33	225	12	PAR	ND	ND	ND	ND	ND	ND	50.0	86.0
6	0055	27	11	17S05E13	225	12	PAR	ND	ND	ND	ND	0.010	ND	50.0	82.0
7	0053	27	15	20S08E08	225	12	PAR	ND	ND	ND	ND	ND	ND	50.0	NA
8	0045	27	10	16S05E33	239	26	PAR	ND	ND	ND	ND	ND	NA	50.0	82.0
9	0046	27	11	17S05E13	239	26	PAR	ND	ND	ND	ND	ND	NA	50.0	83.0
10	0043	27	12	17S06E28	239	26	PAR	ND	ND	ND	ND	0.015	NA	50.0	82.0
11	0041	27	13	19S07E06	239	26	PAR	ND	ND	ND	ND	ND	NA	50.0	75.0
12	0037	27	14	19S07E26	239	26	PAR	0.028	ND	ND	ND	0.038	NA	50.0	77.0
13	0036	27	15	20S08E08	239	26	PAR	ND	ND	ND	ND	ND	NA	50.0	82.0
14	0011	27	07	15S03E28	240	27	PAR	ND	ND	ND	ND	ND	NA	50.0	76.0
15	0019	27	08	15S04E19	240	27	PAR	ND	ND	ND	ND	0.024	NA	50.0	74.0
16	0081	27	09	16S04E03	240	27	PAR	ND	ND	ND	ND	0.037	NA	50.0	85.0
17	0077	27	01	14S03E04	240	28	PAR	0.099	ND	ND	ND	0.037	NA	50.0	81.0
18	0020	27	02	14S02E18	240	28	PAR	ND	ND	ND	ND	ND	NA	50.0	81.0
19	0015	27	03	15S02E03	240	28	PAR	0.060	ND	ND	ND	0.011	NA	50.0	83.0
20	0016	27	04	14S03E31	240	28	PAR	ND	ND	ND	ND	0.10	NA	50.0	86.0
21	0010	27	05	15S03E19	240	28	PAR	ND	ND	ND	ND	ND	NA	50.0	80.0
22	0080	27	06	15S03E03	240	28	PAR	ND	ND	ND	ND	0.010	NA	50.0	84.0
23	0047	27	10	16S05E33	239	26	PEP	ND	ND	ND	ND	ND	ND	50.0	85.0
24	0044	27	11	17S05E13	239	26	PEP	ND	ND	ND	ND	ND	ND	50.0	86.0
25	0042	27	12	17S06E28	239	26	PEP	ND	ND	ND	ND	ND	ND	50.0	87.0
26	0040	27	13	19S07E06	239	26	PEP	ND	ND	ND	ND	ND	ND	50.0	86.0
27	0038	27	14	19S07E26	239	26	PEP	ND	ND	ND	ND	ND	ND	50.0	86.0
28	0035	27	15	20S08E08	239	26	PEP	ND	ND	ND	ND	ND	ND	50.0	87.0
29	0012	27	07	15S03E28	240	27	PEP	ND	ND	ND	ND	ND	ND	50.0	85.0
30	0021	27	08	15S04E19	240	27	PEP	ND	ND	ND	ND	ND	ND	50.0	84.0
31	0082	27	09	16S04E03	240	27	PEP	ND	ND	ND	ND	ND	ND	50.0	84.0
32	0078	27	01	14S03E04	240	28	PEP	ND	ND	ND	ND	ND	ND	50.0	84.0
33	0017	27	02	14S02E18	240	28	PEP	ND	ND	ND	ND	ND	ND	50.0	86.0
34	0014	27	03	15S02E03	240	28	PEP	ND	ND	ND	ND	ND	ND	50.0	86.0
35	0018	27	04	14S03E31	240	28	PEP	ND	ND	ND	ND	ND	ND	50.0	86.0
36	0009	27	05	15S03E19	240	28	PEP	ND	ND	ND	ND	ND	ND	50.0	86.0
37	0079	27	06	15S03E03	240	28	PEP	ND	ND	ND	ND	ND	ND	50.0	86.0

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EXPO1 = NUMBER OF DAYS SAMPLE WAS EXPOSED TO ENVIRONMENT
PTYP1 = SAMPLE TYPE. PAR=PARSLEY PLANT PEP=PEPPER PLANT
DIA1 = DIAZINON CONCENTRATION (ug/g)
DOA1 = DIAZOXON CONCENTRATION (ug/g)
PAR1 = PARATHION CONCENTRATION (ug/g)
POA1 = PARAOXON CONCENTRATION (ug/g)
CHL1 = CHLORPYRIFOS CONENTRATION (ug/g)
COA1 = CHLORPYRIFOXON CONCENTRATION (ug/g)
WWT1 = WET WEIGHT OF PLANT MATERIAL ANALYZED
PMST1 = PERCENT MOISTURE IN PLANT MATERIAL ANALYZED

OBS	SN1	CC1	LC1	TRS1	DATE1	EXPO1	PTYP1	DIA1	DOA1	PAR1	POA1	CHL1	COA1	WWT1	PMST1
1	0061	10	01	11S13E07	224	14	PAR	ND	ND	ND	ND	ND	ND	50.0	83.0
2	0062	10	04	13S15E28	224	14	PAR	ND	ND	ND	ND	0.026	ND	33.5	NA
3	0066	10	07	14S17E12	225	14	PAR	ND	ND	ND	ND	0.010	ND	48.5	NA
4	0065	10	14	14S20E17	225	14	PAR	ND	ND	ND	ND	ND	ND	38.1	NA
5	0067	10	08	18S17E28	225	15	PAR	ND	ND	ND	ND	ND	ND	50.0	NA
6	0064	10	12	17S21E22	225	15	PAR	ND	ND	ND	ND	0.031	ND	50.0	NA
7	0063	10	13	16S20E18	225	15	PAR	0.041	ND	ND	ND	ND	ND	39.9	NA
8	0006	10	03	13S14E25	238	27	PAR	0.11	ND	ND	ND	ND	ND	50.0	75.0
9	0069	10	07	14S17E12	238	27	PAR	0.048	ND	ND	ND	0.027	ND	50.0	82.0
10	0030	10	08	18S17E28	238	27	PAR	ND	ND	ND	ND	ND	ND	42.8	NA
11	0026	10	09	19S16E27	238	27	PAR	ND	ND	ND	ND	ND	ND	50.0	67.0
12	0028	10	10	20S17E10	238	27	PAR	ND	ND	ND	ND	0.012	ND	50.0	80.0
13	1000	10	14	14S20E17	238	27	PAR	ND	ND	ND	ND	ND	ND	47.9	NA
14	0002	10	01	11S13E07	238	28	PAR	ND	ND	ND	ND	ND	ND	50.0	85.0
15	0003	10	02	12S12E09	238	28	PAR	ND	ND	ND	ND	ND	ND	50.0	73.0
16	0007	10	04	13S15E28	238	28	PAR	ND	ND	ND	ND	ND	ND	50.0	77.0
17	0076	10	05	15S16E05	238	28	PAR	ND	ND	ND	ND	ND	ND	50.0	83.0
18	0057	10	06	15S16E25	238	28	PAR	ND	ND	ND	ND	ND	ND	50.0	NA
19	0032	10	11	17S19E24	238	28	PAR	ND	ND	ND	ND	ND	ND	50.0	77.0
20	0034	10	12	17S21E22	238	28	PAR	ND	ND	ND	ND	0.024	ND	49.6	NA
21	0068	10	13	16S20E18	238	28	PAR	0.022	ND	ND	ND	ND	ND	32.7	NA
22	0005	10	03	13S14E25	238	27	PEP	ND	ND	ND	ND	ND	ND	50.0	88.0
23	0074	10	07	14S17E12	238	27	PEP	ND	ND	ND	ND	0.022	ND	50.0	87.0
24	0029	10	08	18S17E28	238	27	PEP	ND	ND	ND	ND	ND	ND	50.0	87.0
25	0025	10	09	19S16E27	238	27	PEP	ND	ND	ND	ND	ND	ND	50.0	87.0
26	0027	10	10	20S17E10	238	27	PEP	ND	ND	ND	ND	ND	ND	50.0	NA
27	1001	10	14	14S20E17	238	27	PEP	ND	ND	ND	ND	ND	ND	44.8	NA
28	0001	10	01	11S13E07	238	28	PEP	ND	ND	ND	ND	ND	ND	50.0	87.0
29	0004	10	02	12S12E09	238	28	PEP	ND	ND	ND	ND	ND	ND	39.2	NA
30	0008	10	04	13S15E28	238	28	PEP	ND	ND	ND	ND	ND	ND	50.0	89.0
31	0059	10	05	15S16E05	238	28	PEP	ND	ND	ND	ND	ND	ND	50.0	87.0
32	0056	10	06	15S16E25	238	28	PEP	ND	ND	ND	ND	ND	ND	50.0	88.0
33	0031	10	11	17S19E24	238	28	PEP	ND	ND	ND	ND	ND	ND	50.0	NA
34	0033	10	12	17S21E22	238	28	PEP	ND	ND	ND	ND	ND	ND	50.0	88.0
35	0075	10	13	16S20E18	238	28	PEP	ND	ND	ND	ND	ND	ND	50.0	89.0

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PTYP1 = SAMPLE TYPE. PAR=PARSLEY PLANT PEP=PEPPER PLANT
DIA1 = DIAZINON CONCENTRATION (ug/g)
DOA1 = DIAZOXON CONCENTRATION (ug/g)
PAR1 = PARATHION CONCENTRATION (ug/g)
POA1 = PARAOXON CONCENTRATION (ug/g)
CHL1 = CHLORPYRIFOS CONENTRATION (ug/g)
COA1 = CHLORPYRIFOXON CONCENTRATION (ug/g)
WWT1 = WET WEIGHT OF PLANT MATERIAL ANALYZED

OBS	SN1	CC1	LC1	TRS1	DATE1	EXPO1	PTYP1	DIA1	DOA1	PAR1	POA1	CHL1	COA1
1	0004	27	01	14S03E04	217	5	KIM	ND	ND	ND	ND	ND	ND
2	0002	27	02	14S02E18	217	5	KIM	ND	ND	ND	ND	ND	ND
3	0001	27	03	15S02E03	217	5	KIM	ND	ND	ND	ND	ND	ND
4	0003	27	04	14S03E31	217	5	KIM	ND	ND	ND	ND	ND	ND
5	0007	27	05	15S03E19	217	5	KIM	ND	ND	ND	ND	ND	ND
6	0005	27	06	15S03E03	217	5	KIM	ND	ND	ND	ND	ND	ND
7	0008	27	07	15S03E28	218	5	KIM	ND	ND	ND	ND	ND	ND
8	0006	27	08	15S04E19	217	4	KIM	ND	ND	ND	ND	ND	ND
9	0009	27	09	16S04E03	218	5	KIM	ND	ND	ND	ND	ND	ND
10	0010	27	10	16S05E33	218	5	KIM	ND	ND	ND	ND	ND	ND
11	0011	27	11	17S05E13	218	5	KIM	ND	ND	ND	ND	ND	ND
12	0012	27	12	17S06E28	218	5	KIM	ND	ND	ND	ND	ND	ND
13	0013	27	13	19S08E06	218	5	KIM	ND	ND	ND	ND	ND	ND
14	0014	27	14	19S07E26	218	5	KIM	ND	ND	ND	ND	ND	ND
15	0015	27	15	20S08E08	218	5	KIM	ND	ND	ND	ND	ND	ND
16	0016	10	01	11S13E07	217	7	KIM	ND	ND	ND	ND	ND	ND
17	0017	10	02	12S12E09	217	7	KIM	ND	ND	ND	ND	ND	ND
18	0030	10	03	13S14E25	218	7	KIM	ND	ND	ND	ND	ND	ND
19	0018	10	04	13S15E28	218	8	KIM	ND	ND	ND	ND	ND	ND
20	0020	10	05	15S16E05	218	8	KIM	ND	ND	ND	ND	ND	ND
21	0021	10	06	15S16E25	218	8	KIM	ND	ND	ND	ND	ND	ND
22	0029	10	07	14S17E12	217	7	KIM	ND	ND	ND	ND	ND	ND
23	0025	10	08	18S17E28	218	7	KIM	ND	ND	ND	ND	ND	ND
24	0026	10	09	19S16E27	218	7	KIM	ND	ND	ND	ND	ND	ND
25	0027	10	10	20S17E10	218	7	KIM	ND	ND	ND	ND	ND	ND
26	0022	10	11	17S19E24	218	8	KIM	ND	ND	ND	ND	ND	ND
27	0023	10	12	17S21E22	218	8	KIM	ND	ND	ND	ND	ND	ND
28	0024	10	13	16S20E18	218	8	KIM	ND	ND	ND	ND	ND	ND
29	0028	10	14	14S20E17	219	8	KIM	ND	ND	ND	ND	ND	ND

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PTYP1 = SAMPLE TYPE. KIM=KIMBIE (MASS DEPOSITION CARD)
DIA1 = DIAZINON CONCENTRATION (ug/kimbie)
DOA1 = DIAZOXON CONCENTRATION (ug/kimbie)
PAR1 = PARATHION CONCENTRATION (ug/kimbie)
POA1 = PARAOXON CONCENTRATION (ug/kimbie)
CHL1 = CHLORPYRIFOS CONENTRATION (ug/kimbie)
COA1 = CHLORPYRIFOXON CONCENTRATION (ug/kimbie)

OBS	SN1	CC1	LC1	TRS1	DATE1	EXPO1	PTYP1	DIA1	DOA1	PAR1	POA1	CHL1	COA
1	0132	27	09	16S04E03	218	520	AIR	0.14	ND	ND	ND	0.39	ND
2	0135	27	09	16S04E03	225	470	AIR	0.10	ND	ND	ND	10.86	6.4
3	0138	27	09	16S04E03	232	485	AIR	0.18	ND	ND	ND	12.77	4.5
4	0133	27	15	20S08E08	218	325	AIR	ND	ND	ND	ND	0.15	ND
5	0134	27	15	20S08E08	225	475	AIR	0.19	0.51	0.26	0.30	0.47	0.4
6	0130	27	15	20S08E08	232	480	AIR	ND	ND	0.10	ND	0.21	ND
7	0128	10	10	20S17E10	218	480	AIR	ND	ND	ND	ND	ND	ND
8	0126	10	10	20S17E10	225	475	AIR	ND	ND	ND	ND	0.16	ND
9	0137	10	10	20S17E10	231	480	AIR	ND	ND	ND	ND	ND	ND
10	0131	10	13	16S20E18	218	480	AIR	0.13	ND	ND	ND	ND	ND
11	0127	10	13	16S20E18	225	480	AIR	17.13	35.15	ND	ND	0.26	ND
12	0136	10	13	16S20E18	231	480	AIR	4.91	4.37	0.12	ND	0.51	ND

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DATE1 = DATE SAMPLE COLLECTED. JULIAN DATE
EXPO1 = HI VOL AIR SAMPLER RUN TIME (MINUTES)
PTYP1 = SAMPLE TYPE. AIR=AIR
DIA1 = DIAZINON CONCENTRATION (ug/sample)
DOA1 = DIAZOXON CONCENTRATION (ug/sample)
PAR1 = PARATHION CONCENTRATION (ug/sample)
POA1 = PARAOXON CONCENTRATION (ug/sample)
CHL1 = CHLORPYRIFOS CONENTRATION (ug/sample)
COA1 = CHLORPYRIFOXON CONCENTRATION (ug/sample)